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TRYPANOSOMIASIS.

DEUTSCHMAN (S.). **Geographical Distribution of Human Trypanosomiasis in Africa.**—*League of Nations Epidemiol. Rep.* 1936. Oct.–Dec. Vol. 15. No. 10–12. pp. 201–218. With 2 maps. [14 refs.] [French version also.]

This paper records the present position as regards sleeping sickness in the various countries in tropical Africa ; the statements are based on recent official reports, mainly those of 1935, but failing them on those of 1934. All this information is summarized in a table.

In French West Africa (Sudan, Niger, Ivory Coast, Dahomey and Guinea) the total number of persons examined during 1934 was 916,393 ; amongst these 25,030 new cases and 25,518 old cases of sleeping sickness were found. The figures for each of the various countries are given in a table.

In the Gold Coast, the number of sleeping sickness cases treated in hospitals and dispensaries is constantly rising. In 1929–30, sleeping sickness patients amounted to 6·6 per 100,000 cases treated ; 33·1 in 1932–33, 91·3 in 1934, and 177·8 (3,885 cases) in 1935. The author states that this enormous increase is very largely explained by the fact that treatment is becoming popular, and by the change in the attitude of the natives.

In the Gambia, 1,106 cases with 32 deaths were recorded in 1935. In Sierra Leone, 4 cases were treated in 1934 and 4 also in 1935. In Portuguese Guinea a sleeping sickness mission in 1932 discovered 18 cases.

In Nigeria, 6 sleeping sickness units, each consisting of a medical officer, 2 native nurses and 18 to 24 native dispensary attendants, operated in 1934. They examined 381,712 persons and discovered 43,017 cases, of which less than 600 had been treated previously. Furthermore, 4,613 cases were treated in dispensaries and hospitals of the Colony. The distribution of these cases throughout Nigeria is shown in a table.

The activities of the sleeping sickness surveys between 1922 and 1935 in the Cameroons under French mandate are summarized in a table. At the end of 1935, out of 146,116 cases discovered at various dates since 1920, 39,150 had died. In 1935 the number of persons examined was 557,327 and among these 3,614 new cases of the disease were found.

The results of the sleeping sickness campaign in French Equatorial Africa between 1924 and 1934 are shown in a table. In 1934, the number of persons examined was 1,440,676 and 42,508 old cases were seen and treated, and 13,368 new cases discovered. No fewer than 41,000 lumbar punctures were performed.

The activity of the sleeping sickness service in the Belgian Congo between 1927 and 1935 is summarized in a table. In 1935, 4,356,270 persons were examined, and 66,775 old cases were kept under observation, and 18,930 new cases discovered.

Another table shows the number of cases of the disease recorded in Uganda from 1931 to 1935 ; in the last year there were 675 cases with 72 deaths. In Kenya 15 cases were discovered in 1935. The number of cases discovered in Tanganyika each year between 1931 and 1935 is shown in a table. In 1935 there were 1,075 cases and 342 deaths. In Portuguese East Africa, 28 cases were recorded during 1935 ; in Northern Rhodesia, 50 cases, none in Southern Rhodesia and 2 in Nyasaland.

In Bechuanaland the first 2 cases were recorded in 1934. In Angola the cases reported in 1935 were distributed as follows :— 1,232 (24 deaths) in the coastal districts, 12 (1 death) in the districts adjoining the border, and 198 (14 deaths) in those of the interior. In Spanish Guinea the presence of the disease is reported in the island of Fernando Po and on the continent. The epidemic area, which, up to 1925, was limited to the Coast, has since invaded the whole continental area of the Colony.

As the result of this summary the author draws the following conclusions :—

" In the African territories situated between the tropics, the total population of which may be estimated at 65 millions, nearly 7 millions were examined in the course of a single year. 140,000 fresh cases were discovered and treated, besides a similar number of old cases.

" In territories where the campaign has been going on for a long time (Belgian Congo, French Equatorial Africa, Cameroons under French mandate), out of nearly 15 million inhabitants, the number examined in the course of a year exceeds 6 millions.

" Recent surveys carried out in colonies west of the Cameroons show that sleeping-sickness holds a more important place among diseases in West Africa than was supposed hitherto.

" In certain endemic areas such as those of Kwango in the Belgian Congo, Nola in the Middle Congo, Abong M'bang in the Cameroons, and Djouah in Togoland, the results obtained from a ceaseless campaign do not yet permit us to foresee an early eradication of the disease.

" Agricultural prophylaxis, the importance of which is paramount, is still at a rudimentary stage. In certain areas where it has been put into practice, it gives encouraging local results. It meets, however, with considerable economic and administrative difficulties."

W. Yorke.

LESTER (H. M. O.). **Report of the Tsetse Investigation and Sleeping Sickness Service.**—*Nigeria Ann. Rep. Med. Services 1935.* Appendix B. pp. 71–76.

During the year, 407,203 people were examined at surveys in the field and 84,364 were found to be suffering from trypanosomiasis. Altogether 87,369 cases were treated by the teams ; this number included 4,000 patients who were diagnosed at the end of 1934. As no

re-surveys were carried out during the year practically all these patients were new cases. A further 4,358 patients were treated at field dispensaries and 4,825 at general medical stations, making a grand total of 96,552 cases of sleeping sickness treated during the year.

In spite of intensive campaigns of mass treatment and the establishment of sleeping sickness dispensaries, the disease is not yet under control. New areas are becoming infected and the type of disease in some of the older epidemics is becoming worse.

As a result of a Conference held at Kaduna on 27th November, 1935, a scheme was drawn up as a five years' plan to be reviewed towards the end of that period. It provides for (*a*) improved organization of the sleeping sickness teams to include the appointment of a number of R.A.M.C. British Non-Commissioned Officers to supervise the teams in the field and relieve the strain on the medical staff, (*b*) staff to advise upon protective clearings and to supervise such work, and (*c*) staff and funds to organize and carry out concentration of population in certain districts. The Emir of Zaria was consulted with regard to the movement and concentration of population.

The research work carried out during the year on the testing of new chemical compounds took a prominent place. The investigation of the action of Surfen C on trypanosomiasis of cattle was transferred to the Veterinary Department, and this work is now being done at Vom. Preparations 6210, 6558, 5547 and 6690 supplied by the Bayer Company were tested against *T. vivax* in sheep. None of these preparations proved to be as effective as Surfen C.

The following compounds have been tested in man, *viz.*, S.107 supplied by the Chemotherapy Committee of the Medical Research Council, and Sdt.386B, 411 and 471 (antimonials) supplied by the Bayer Company, and Dn.18 (an antimonial) supplied by the Union Chemique Belge.

Experiments on the effect of exposing "premunized" animals to fresh infections, which were started in 1934, have been continued. It was found that although previous injections had given cattle some degree of resistance this was not sufficient to influence the mortality when the cattle were exposed to *G. submorsitans* in the bush. Dr. Nash, the Entomologist, has continued his researches, and one or two papers have been published by him during the year.

Writing on the therapeutic measures adopted during the year, Lester states that almost all field cases had been given a standard form of treatment, consisting of three one-gram doses of Antrypol or Bayer 205, followed by five two-gram doses of tryparsamide. From the point of view of amelioration of symptoms this form of treatment appeared to be as good as the longer course of tryparsamide. It is more effective in that both Bayer and Antrypol have a greater trypanocidal action than tryparsamide, so that relapses are less likely to occur. As the course of treatment is shorter it is much more popular with the community. Reference is made to certain untoward consequences of the administration of Bayer and Antrypol. These are vomiting, especially after the dose is injected too quickly, occasional transient oedema and rash, and mild peripheral neuritis. Unfortunately, a small number of alarming cases of collapse have occurred both after Antrypol and Bayer; three of these patients died.

The report concludes with observations on the work of the dispensaries, the treatment of mines labour, and protective measures.

W. Y.

LAMBORN (W. A.). **Report on the Incidence of Sleeping Sickness in Ngamiland, Bechuanaland Protectorate.**—*Bechuanaland Protectorate Ann. Med. & San. Rep. Year 1935.* Appendix B. pp. 36–52.

The author was lent to the Bechuanaland Government by Nyasaland in order that he might examine the instance of sleeping sickness in the Okovango swamps in Ngamiland and formulate recommendations for the control of the disease. Although the occurrence of sleeping sickness in this fly area had been disputed for many years, it was not until November 1935, that two definite cases of sleeping sickness were reported by Dr. MacKenzie. Lamborn gives the following summary of his observations and conclusions :—

" Every native living in the villages situated in the southern fly area, and those bordering it, a total of 258, were medically examined. There was an entire absence of the signs and symptoms of Sleeping Sickness and all the blood films proved negative.

" It is doubtful whether Sleeping Sickness has ever occurred in this area. Four cases considered by the natives to be ' Kgotsella ' were certainly not Sleeping Sickness.

" All natives living in the northern fly area or near it, a total of 186, were medically examined ; again without result and all the blood films were negative.

" Evidence showing that a minor epidemic in which thirteen bushmen recently lost their lives, almost certainly from Sleeping Sickness, was obtained, and it must have been in their village that the two police constables became infected.

" Though the epidemic is at an end it is recommended that the population in this northern area should be removed and settled in a fly free neighbourhood from which many originally came, steps being taken to guard against their return.

" The wanderings of bushmen through both fly areas should be terminated.

" The Administration of South West Africa should be invited not only to take steps to ascertain the position as regards tsetse and Sleeping Sickness in the Caprivi Strip ; but should be asked to co-operate with a view to preventing natives in it coming into the fly areas of this country.

" Control of the movements of the bushmen is also called for, since, owing to their predilection for the fly areas as hunting grounds, they are more likely than natives of other tribes to become infected and by their nomadic habits to spread infection far and wide, as might well have been the case in the present instance. Headmen might well be instructed to report the presence of bands of them, which should be relegated to the region south of the Kasane-Maun-Tsao-Nokaneng road, pressure being brought to bear on them if they returned.

" The tendency of natives to proceed into fly areas in search of foodstuffs such as the pith of the wild date palms, the corns of papyrus and various roots might well be checked if they could be induced to cultivate some alternatives to the millet or maize, which in the areas I visited seem to be their sole crops, and which are said often to fail from failure of the rainfall or from locusts, as seems to have been the case in the present year. Rice, for instance could be grown, I feel sure, in almost unlimited quantities in the swamp areas : yet seems to be quite unknown. The foundations for a flourishing export trade to the Union when internal communications are improved might well be laid if natives could be induced to cultivate this cereal.

" Varieties of the sweet potato, too, could certainly be grown in moist land at the edge of the swamp, as it is grown round Lake Nyasa, at a season when the season for cereals is over ; and the cultivation of cassava in the sandy soil must offer possibilities." *W. Y.*

Congo Belge: Rapport sur l'Hygiène Publique au Congo Belge pendant l'Année 1935 [van Hoof (L.)]. [**Trypanosomiasis** pp. 27–42. With 1 map.]

In this report the position of sleeping sickness in the various parts of the Belgian Congo is summarized. During the year 6 Europeans have been found to be infected, 4 in the province of Leopoldville, 1 in that of Lusambo, and 1 in Elisabethville. In a table the number of people examined, the number of old cases kept under observation, the number of new cases discovered and the index of new infection are given for each of the years 1927 to 1935. In 1935, 4,356,270 persons were examined, 66,774 old cases kept under observation, 18,930 new cases discovered, and the index of new infection was 0·43 per cent. Another table summarizes these data in respect of each of the Provinces, *viz.*, Leopoldville, Lusambo, Coquilhatville, Stanleyville, Costermansville and Elisabethville. A brief account of the present state of affairs in each of these provinces follows. *W. Y.*

Vleurinck. Rapport concernant l'influence du chemin de fer sur la dissémination des glossines au Katanga. [**Report on the Influence of the Railway in disseminating Glossina in Katanga.**]—*Bull. Méd. du Katanga.* 1936. Vol. 13. No. 3. pp. 104–5, 107–13. With 1 map.

This investigation was conducted in order to ascertain how far the railway disseminated Glossina, and in particular whether it is conveying infected Glossina from Malondo to the agricultural regions around Elisabethville. A systematic examination of the trains from the north was made at Lubudi station from 17 April to 7 May, 1935; this period is at the beginning of the rains when tsetse are most common. During the 21 days 19 trains reached Lubudi from the north and only 12 tsetse (*G. morsitans*) were found.

The author describes how on one occasion he made a journey by trolley from Simbala to Kalule accompanied by 4 natives, 2 of whom pushed the trolley and 2 sat by him. Tsetse were particularly numerous and there were always at least 50 around them. The boys amused themselves by catching them and putting them in a heap in front of the trolley in order that they might have the pleasure of hearing them crushed. During the 45 minutes journey at least 300 flies were destroyed in this way. Vleurinck was informed that this was a usual pastime with the trolley boys. He does not see in this procedure a way of exterminating the fly, but he contends that the railway destroys a hundred times more flies than it transports. His general conclusion is that the railway does not constitute a serious danger for the transportation of infected tsetse. *W. Y.*

Stewart (J. L.). **Porcine Trypanosomiasis in the Gold Coast.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. Nov. 28. Vol. 30. No. 3. pp. 313–314.

Owing to the fact that the pig population of the Gold Coast is largely in the forest where no veterinary staff is stationed, trypanosomiasis has only recently been diagnosed in them. A few years ago *T. brucei* was found in grade pigs in the Northern Territories, and this year *T. simiae* has been found for the first time in West Africa in a flock of swine near Kumasi.

An excellent opportunity for observing the effects of *T. brucei* infection appeared in 1934, when 17 cases occurred amongst grade pigs at Pong-Tamale Farm. The symptoms were characteristic—inappetence and weakness of the hindquarters, followed by chronic progressive anaemia ; the temperatures were normal and trypanosomes in small numbers were present in the blood.

The epidemic, due to *T. simiae*, was apparently severe, as a Syrian, who owned a herd of about 150 head of mixed grade Yorkshire and native pigs, lost 100 in a few weeks from a sudden fatal disease. From the history it would appear probable that no symptoms occur in infected pigs until the infection reaches a very high degree of intensity (trypanosomes are said to be swarming in the blood) and then the animal dies of an acute septicaemia in much the same way that anthrax affects cattle. *W. Y.*

HOARE (Cecil A.). **Note on *Trypanosoma simiae* from an Outbreak amongst Pigs in the Gold Coast.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. Nov. 28. Vol. 30. No. 3. pp. 315–316. With 7 figs.

Hoare had an opportunity of examining blood films sent to him by Stewart from pigs infected with *T. simiae* at Kumasi. After giving a brief account of the morphology of the parasite Hoare writes :—

" It is thus seen that both qualitatively and quantitatively *T. simiae* from the Gold Coast pigs reveals the same features as the other strains of this trypanosome described by me. This fact provides further evidence that the polymorphism of *T. simiae* is not due to mixed infections, but represents a constant characteristic of this species."

W. Y.

HORNBY (H. E.). **Trypanosomiasis of Pigs due to *Trypanosoma simiae*.**—*Tanganyika Territory Ann. Rep. Dept. Vet. Sci. & Animal Husbandry 1935.* pp. 43–48. With 2 figs. on 1 plate.

The author gives an account of the trypanosome found producing an acute disease in pigs in Tanganyika Territory. He summarizes his observations as follows :—

" Outbreaks of acute porcine trypanosomiasis occur from time to time in Tanganyika Territory.

" The course of the disease is extremely rapid ; death may occur within a week of infection and after only a few hours visible illness. During this time of visible illness trypanosomes are usually extremely abundant in the blood.

" The appearance of these trypanosomes varies. In some cases they closely resemble *T. congolense*, but in many other cases the majority are dividing so rapidly that they appear to be in a state of multiple, rather than the ordinary binary, fission. The single individuals in these cases vary much in appearance ; some resembling *T. congolense*, that is fairly broad and with little or no free flagellum ; some being much thinner than these with a definite free flagellum, and some intermediate between these extremes. When, however, sub-inoculations are made from the pig to the sheep, only *T. congolense*-like parasites may be expected to appear. A careful study of these sheep forms brings them definitely into line with *T. simiae*, described by Bruce *et al.* in 1914. It would appear, however, that these workers overlooked the peculiar forms into which *T. simiae* often divides when multiplying at an enormous rate in the pig.

" It is these unusual forms which have led to much misunderstanding concerning the species. They have been described by Walravens as constituting a new species, *T. rodhaini*, but this name should now disappear.

" In experiments at Mpwapwa, a calf was found to be refractory to infection, and only very transient infection was set up in the rabbit and guineapig. Sheep were infected easily, and a disease almost indistinguishable from that of *T. congolense* set up. As, however, a characteristic of *T. simiae* is the rapidity with which its pathogenicity is modified by passage, it was not surprising that after only a few passages the strain died out in its laboratory hosts and was lost.

" On epizootiological grounds it is almost certain that outbreaks in herds of pigs are initiated by a tsetse fly, but that spread within the herd is through mechanical transmission by flies other than tsetse. For this reason, if the disease appears, the pigs should be divided into as many small groups as it is possible to keep separate, and thus mechanical transmission will be checked."

W. Y.

ADAMS (A. R. D.). **Trypanosomiasis of Stock in Mauritius. III. The Diagnosis and Course of Untreated *T. vivax* Infections in Domestic Animals.**—*Ann. Trop. Med. & Parasit.* 1936. Dec. 23. Vol. 30. No. 4. pp. 521–531.

In this paper Adams continues his interesting studies of *T. vivax* infections of stock in Mauritius. He gives the following summary of his work :—

" 1. Two strains of Mauritian *T. vivax* were maintained in ruminants by subcutaneous inoculation of small quantities of blood from animal to animal.

" 2. The experimental animals were segregated and kept in a number of efficiently fly-proofed stables under good conditions of maintenance.

" 3. Sheep were found to be highly susceptible to the infection. Four animals died of acute trypanosomiasis inside a period ranging from two weeks to two months after the infecting inoculation.

" 4. Goats were also highly susceptible and died in the majority of cases from the disease in a similar period. Some few, however, survived the immediate effects, and appeared to develop a considerable tolerance to the parasite.

" 5. Cattle were readily infected, but proved relatively resistant to the effects of infection. All developed a high degree of tolerance-immunity after some weeks of subacute febrile disturbance.

" 6. Pigs proved refractory to infection, as were all the ordinary smaller laboratory animals.

" 7. Attempted superinfection of two cattle with either a homologous or a heterologous strain of the same parasite failed to produce any apparent result.

" 8. Gland puncture was explored as a method of diagnosis of the experimental infections in cattle, sheep and goats. It was found that on occasion trypanosomes were recovered 24 or 48 hours earlier in the gland juices than in the peripheral blood of these animals.

" 9. In sheep and goats which eventually died from acute or subacute trypanosomiasis, gland puncture did not prove superior to blood examination as a diagnostic technique. In several instances it was inferior both in regard to the frequency of positive results and in the numerical concentration of parasites.

" 10. In cattle, trypanosomes were frequently present in the prescapular glands in greater concentration than in the peripheral blood during the first few weeks of the subacute stage of the infection. After this, each method gave closely similar findings. In certain cases

trypanosomes were found in considerable numbers in both the blood and gland juices, after being absent for very prolonged intervals, as a result of lowering of the general resistance by accidental injuries.

" 11. Neither gland puncture nor peripheral blood examination is an efficient method of excluding a latent or chronic *T. vivax* infection in ruminants.

" 12. It is suggested that the administration of some drug, such as histamine, to produce severe systemic shock, might profitably be employed to break down temporarily the balance existing between trypanosome and mammalian host and to reveal such latent infections. These cryptic infections have been shown to persist certainly for many months and probably for years, and are of very considerable importance in that they constitute a hidden reservoir of infection in epizootic or enzootic areas."

W. Y.

DUKE (H. Lyndhurst). **Some Recent Advances in the Biology of Trypanosomes of Sleeping-Sickness.**—*League of Nations Epidemiol. Rep.* 1936. Oct.–Dec. Vol. 15. No. 10–12. pp. 187–200. [25 refs.] [French version also.]

In this article Duke gives a semi-popular review of recent work on human trypanosomiasis. He deals with such subjects as: The factors which influence the development of trypanosomes in Glossina; arsenic-resistance; man's resistance to trypanosomes of the *brucei* group; behaviour of man's trypanosomes in animals; and the origin of *T. rhodesiense*. As all these matters have already been fully discussed by Duke in previous papers no further notice is required in this *Bulletin*.

The following are Duke's conclusions :—

" In spite of the uncertainty that still surrounds some of the major problems of human trypanosomiasis, there are, nevertheless, certain clear indications to direct those called upon to administer the infected territories in Africa.

" One thing is clear : man must be protected, not only from *G. palpalis*, but also from game-feeding tsetse.

" In *palpalis* areas, the control of sleeping-sickness, although a matter of enormous difficulty and expense, is simply a question of breaking contact between tsetse and man. The enormous numbers of people affected and the diffuse distribution of this tsetse along countless streams and rivers are the main obstacles to success.

" In game-tsetse areas, the problem, though still difficult, is in some ways not so complex, for the population affected is nothing like so extensive. There is, however, an added danger in the tendency of certain of the game tsetses to spread to settled areas.

" Human settlement in game country must be protected from game tsetse. Game alone, apart from its bad effect on stock and food crops, is not harmful, save in as much as it may attract tsetse.

" Where settlement is necessary in game-tsetse areas, the game must be exterminated as part of the measures to ensure protection of the population against game tsetses.

" Isolated settlements in areas mainly given over to tsetse supply just the conditions that favour the appearance of *T. rhodesiense*.

" Settlements in the vicinity of game tsetse should be under a form of supervision by which the natives are enabled to co-operate with the authorities to ensure their own protection. Experience in the Congo, in Tanganyika and the Southern Sudan has shown how much can be effected by judicious concentration of scattered settlements in the campaign against tsetse.

" There is still, and will be for many years to come, plenty of room in Africa for both natives and game. But compromise is dangerous. Native interests must be paramount. Game, as a valuable and irreplaceable asset to the territories where it occurs, must be preserved wherever possible.

" There is danger in indiscriminate preservation, just as there is danger in the indiscriminate destruction of wild game. Game-preserves must be properly defined and measures must be devised to supervise visitors, black and white, who are liable to exposure to tsetse. In the meantime, the value of Bayer 205 as a prophylactic against infection may be borne in mind.

" At the present day in Africa, owing to the operation of causes such as denudation, reckless and improvident native agricultural methods and lack of water-supplies, there are large areas that are derelict and given over to scrub and tsetse and game. The soil is so exhausted that settlement is only possible under great hardship and privation.

" Simultaneously with measures to ensure breach of contact between population and tsetse, there must be the organisation of the resources of the territories to ensure proper agricultural development, and to control the appalling destruction of soil values proceeding day by day over huge areas in Central Africa, and due, in the last analysis, to the inadequate conservation and control of rain-water.

" Endemic sleeping-sickness is a disease associated with poverty—inadequate food, poor physique, low resistance and standards of living. And such are the penalties attaching to life in fly-country.

" Improve the native's standard of living and teach him the elements of sanitation, and the admirable results attained in the Sudan, in the Belgian Congo and in Tanganyika will follow in due course. With modern remedies, the disease has lost many of its terrors for the European. But it is still a serious menace to human life in many a remote territory in the central zone of Africa, as may be seen in the distribution tables following this article.

" Unfortunately, expenditure on the control of sleeping-sickness often promises little or no direct economic return. But it is imposed upon us Europeans as part of an heritage of responsibility, into whose hands have been given the lives and well-being of hundreds of thousands of ignorant and helpless natives.

" We must remember that the opening-up of the continent during the last thirty years or so has facilitated the spread of human trypanosomiasis. Let us then acknowledge our obligations and vigorously continue the campaign until sleeping-sickness is no longer a major scourge, or even a remote menace to man in Africa."

W. Y.

DUKE (H. Lyndhurst). **Recent Observations on the Biology of the Trypanosomes of Man in Africa.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. Nov. 28. Vol. 30. No. 3. pp. 275–296. [42 refs.] Discussion pp. 297–308.

In this address to the Royal Society of Tropical Medicine, Duke presents the results of nearly 25 years of almost continuous work on the study of trypanosomiasis. Under these circumstances, it is not surprising that he covers a vast field.

The first portion of the Address is concerned with the factors which may influence the adaptation of man's trypanosomes to tsetse ; the second portion deals with the subject of arsenic-resistance ; the third portion is concerned with the power of trypanosomes of the *brucei* group to infect man ; the fourth portion with the behaviour of man's trypanosomes in animals, and the fifth portion with the origin of *T.*

rhodesiense and the rôle of the game in the spread of human trypanosomiasis.

All the observations on which Duke bases his arguments have already been published elsewhere and have been noticed in this *Bulletin*. The present paper, which is of great interest, cannot be adequately summarized and must be consulted in the original.

Duke, in his introductory remarks, said that the success of his paper would be measured by the discussion it provoked. On this criterion Duke must be well satisfied, because his paper was followed by a long and animated discussion in which the reviewer, Muriel Robertson, Chesterman, Davey, Johnson, Hoare, Brown, Buxton, and the President took part. *W. Y.*

DUKE (H. Lyndhurst). **Studies of the Effect on *T. gambiense* and *T. rhodesiense* of Prolonged Maintenance in Mammals other than Man : with Special Reference to the Power of these Trypanosomes to infect Man. V. The Effect of Prolonged Maintenance away from Man on the Infectivity of *T. rhodesiense* for Man.**—*Parasitology*. 1937. Jan. Vol. 29. No. 1. pp. 12–34. [15 refs.]

The author's earlier investigations on this subject have already been published [this *Bulletin*, 1935, Vol. 32, pp. 688, 690]. In the present paper, five strains are dealt with, three of them, Tinde I, II, and III, have already formed the subject of the previous communications, whilst the other two, KB and KH, were received from Tanganyika at the end of 1934. A full description of the manner of maintenance of each of these strains and of the tests made with them is given.

In summing up his observations, Duke states that it is with some reluctance that he now attempts to draw general conclusions from them, but the closure of the Institute makes it necessary to produce some kind of general summary. This he does in the following words :—

" (1) *T. rhodesiense* may survive in antelope for at least 2½ years in a form transmissible by tsetse.

" (2) Strains of *T. rhodesiense* differ in their adaptability to antelope.

" (3) Individual antelope react differently to the same strain ; some throw off infection more quickly than others. There is some evidence to show that of the four species examined, bushbuck and reedbuck are better suited to requirements of the trypanosome than oribi and situtunga.

" (4) Strains of *T. rhodesiense* differ in their power to infect man ; some lose this power more readily than others.

" (5) There is reason to believe that with strains whose pathogenicity to man is neither very stable nor pronounced, the inoculation of the blood forms of the trypanosome is more likely to produce infection in man than the introduction of metacyclic forms by the bite of an infective tsetse.

" (6) Some new evidence has been brought forward that flies infected from an antelope carrying *T. rhodesiense* may fail to infect man, whereas flies infected from a monkey that has been infected by an inoculation of the same antelope's blood may infect man.

" (7) A study of all the results obtained during the last few years at Entebbe leads me to conclude that although an antelope may remain infected with *T. rhodesiense* for a year or two, there is a definite tendency for the trypanosome in these circumstances to lose its infectivity for man. An important point is this. Although a trypanosome after long residence in antelope, when isolated in laboratory animals and tested from time to time in man, may infect all or the majority of the volunteers employed, nevertheless when the tests are performed by means of flies infected from the antelope itself the results on man may be very irregular. This

irregularity cannot be explained by the failure of the flies actually to bite the volunteer.

" (8) After a time, varying according to the individual and species of animal from a few months to more than 2 years, *T. rhodesiense* appears to die out in the blood of antelope. Such an animal is, however, susceptible to reinfection with another strain of *T. rhodesiense*, a very short time after the disappearance of the first infection. This suggests that immunity may gradually be established in an antelope repeatedly exposed to infection.

" Whether an antelope ever becomes *permanently* immune against *all* strains of *T. rhodesiense* has not been determined, but it appears likely that this process will be slow.

" (9) Interesting results have followed the testing on man of the trypanosome in the reinfected antelope. This has been done with one bushbuck and two reedbuck. In each test several flies with heavy gland infections were proved (by dissection and finding blood corpuscles) to have bitten clean volunteers. The reinfection strain in the bushbuck failed to infect man ; those of the two reedbuck succeeded.

" It was found some years ago with sheep and goats that a prolonged infection with *T. gambiense* resulted in the reduction or complete loss of the transmissibility of the strain in that animal. If, after this had happened the animal was then superinfected with another and readily transmissible strain, and the trypanosomes in the superinfected animal were examined one month or so later, their transmissibility by tsetse was either much reduced or lost.

" The reinfection experiment with bushbuck III reveals similar features. The transmissibility of the reinfected strains was, it is true, unimpaired—we know now that *T. rhodesiense* is much better adapted to life in antelope than *T. gambiense*—but the partially immunized animal in this case has apparently exerted an effect on another physiological quality of the trypanosome, viz. its pathogenicity to man, as tested in two volunteers.

" (10) A spotted hyaena (*Crocuta crocuta germinans* Matschie) was infected with *T. rhodesiense*. Two years later the animal appeared to be in excellent health, never having manifested any symptoms of illness. 569 days after its first infection trypanosomes were isolated from this hyaena and found on frequent tests to be regularly pathogenic to man.

" (11) Prolonged maintenance of *T. rhodesiense* in guinea-pigs has been found on several different occasions to lead to impairment of the pathogenicity of the strain for man."

W. Y.

DUKE (H. Lyndhurst). **Studies of the Effect on *T. gambiense* and *T. rhodesiense* of Prolonged Maintenance in Mammals other than Man : with Special Reference to the Power of these Trypanosomes to infect Man. VI. Strain " Kahondera " from Southern Rhodesia, and Concluding Observations on this Series of Papers.**—*Parasitology*. 1937. Jan. Vol. 29. No. 1. pp. 35–42.

This paper, which was the last to be published from the Uganda Institute, gives an account of Strain Kahondera from Southern Rhodesia, and this is followed by a brief discussion of the origin of *T. rhodesiense*.

A Kahondera strain was isolated from a native of Gowe in the Hartley-Sebungwe area of Southern Rhodesia. Kahondera was one of three infected natives detected by Dr. BLAIR during an exhaustive survey of the area. The Gowe settlement coincided with one of the said areas depicted on the tsetse maps of the Protectorate and called by JACK " residual foci," where tsetse survived the great rinderpest outbreak of 1896.

The conditions at Gowe were therefore peculiarly favourable to the development of a human strain of *T. brucei*, for man had there been in contact with the fly and trypanosome for many years. After giving a description of the morphology, pathogenicity and the reaction to arsenicals of this trypanosome, Duke passes to a consideration of its identity: is it *T. gambiense* or *T. rhodesiense*? When first isolated from man the trypanosome was only moderately virulent in laboratory animals, but on passage its virulence increased. The strain was very much more resistant to arsenic than typical *T. gambiense*. Posterior-nuclear forms were rarely encountered. Apparently, then, the trypanosome possesses some of the characters of *T. gambiense* and some of *T. rhodesiense*, but in Duke's opinion the evidence points rather to *T. rhodesiense*. *W. Y.*

Brutsaert (P.) & Henrard (C.). La culture des trypanosomes pathogènes. Résumé. [**Cultivation of the Pathogenic Trypanosomes.**]—*Ann. Soc. Belge de Méd. Trop.* 1936. Dec. 31. Vol. 16. No. 4. pp. 479–481.

In their attempts to culture the pathogenic trypanosomes, the authors used 5 different media of the following compositions:—

i. Equal parts of citrated human blood and Ringer solution containing 0·6 per cent. NaCl.
ii. Equal parts of citrated human blood and Locke's solution.
iii. Medium i to which was added 0·5 gm. per litre of cholesterol.
iv. Medium i to which was added 10 gm. of Witte's peptone and 10 gm. of Coignet's gelatine (gold medal).
v. Citrated human blood and Thyrode's solution.

The following table gives the principal results obtained in course of 16 experiments with 6 strains of *T. gambiense*, 1 strain of *T. brucei* and 3 of *T. congolense*:—

Strain of trypanosomes	Date of commencement of culture	Number of sub-cultures	Number of days	Observations
T. gambiense ... Gangwele 4	12.7.35	49	428	
T. gambiense ... Gangwele 4 from guineapig 239	3.4.36	19	161	The same strain as the previous passed through a monkey–fly–guineapig
T. gambiense ... from guineapig 412	13.3.36	23	182	
T. brucei ... ... strain (from Pr. Schilling of Berlin) from guineapig 398	18.2.36	24	206	
T. congolense ... Stanleyville from guineapig 272	8.10.35	36	339	

The best results were obtained with Medium iii and the next best with Media i and v. Reichenow showed that old laboratory strains of

trypanosomes cultured less easily than recently isolated strains [this *Bulletin*, 1933, Vol. 30, p. 118]. The authors found that non-transmissible strains could not be cultured ; but, on the other hand, they also failed with certain strains which were readily transmissible by Glossina.

In order to ascertain whether the culture forms would infect Glossina, Brutsaert and Henrard fed 51 *G. palpalis* on cultures of *T. gambiense* and found 4 " gut " infections and 1 " gut + proventriculus " infection ; 25 tsetse were fed on *T. congolense* cultures and 1 " gut " infection was obtained. It is also interesting to note that 2 goats were infected with *T. congolense* after it had been cultured for 156 days. *W. Y.*

Hoare (Cecil A.) & Bennett (S. C. J.). **Morphological and Taxonomic Studies on Mammalian Trypanosomes. III. Spontaneous Occurrence of Strains of *Trypanosoma evansi* Devoid of the Kinetonucleus.**—*Parasitology*. 1937. Jan. Vol. 29. No. 1. pp. 43–56. With 1 map & 7 figs. [21 refs.]

An account is given of the spontaneous occurrence of strains devoid of a kinetonucleus in *T. evansi* from the Anglo-Egyptian Sudan. Four of these strains are recorded, and were discovered in widely separated localities within the enzootic area of camel trypanosomiasis.

A critical review is given of the question of " akinetonucleate " trypanosomes in general. While the factors causing the appearance of " akinetonucleate " individuals and strains under natural conditions could not be ascertained, irregular division of the trypanosomes is held to be mainly responsible for the elimination of the kinetonucleus and for the persistence of the aberrant condition. *W. Y.*

Murgatroyd (F.) & Yorke (Warrington) with an Appendix by J. F. Corson. **Studies in Chemotherapy. XIII.—The Changes observed in *T. brucei* during Five Years' Maintenance in the Laboratory.**—*Ann. Trop. Med. & Parasit.* 1937. Apr. 8. Vol. 31. No. 1. pp. 145–163.

The object of this work was to learn something of the changes which occurred in a strain of trypanosomes during prolonged maintenance by various methods in a European laboratory. The investigation commenced in August 1931, when a strain of *T. brucei* recently isolated from wild *G. morsitans* in Uganda was sent to this country in guineapigs. The authors summarize their observations as follows :—

" 1. In view of the well-established fact that arsenicals are of little use in the treatment of human beings suffering from *rhodesiense* sleeping sickness, the extreme sensitiveness to these drugs of our old laboratory strain of *T. rhodesiense* in mice was very surprising.

" 2. Three strains of *T. rhodesiense* were obtained from recently diagnosed and untreated Tanganyika cases of sleeping sickness. These strains in mice of the first passage proved refractory to arsenical treatment, but in mice of later passages were definitely more susceptible.

" 3. These observations caused us to investigate experimentally the changes experienced by a trypanosome during its maintenance in the laboratory. The trypanosome used was *T. brucei* recently isolated from wild fly in Uganda. This parasite was maintained in four different ways during a period of 5½ years, and the changes were carefully observed. The characters considered were morphology, pathogenicity, susceptibility to arsenicals and transmissibility by *G. morsitans*.

" 4. It was found that all the four strains underwent modifications, but that those of the strains passaged through mice were much more rapid and pronounced than those of the strains passaged through guinea-pigs.

" 5. The mouse-passage strains exhibited changes of morphology; greatly increased pathogenicity for mice and greatly decreased pathogenicity for guineapigs; greatly increased sensitiveness to arsenicals; and loss of transmissibility by *G. morsitans*.

" The guinea-pig-passage strains exhibited no change of morphology; they showed a gradual increase in pathogenicity for guinea-pigs and mice, and eventually a marked increase in sensitiveness to arsenicals, but this last change appeared more slowly than in the mouse-passage strains. These strains likewise finally lost their capacity of being transmitted by Glossina, but it must be noted that this character persisted for 4 years in Strain 3, which was passed from time to time through Glossina. So long as this strain remained transmissible by Glossina, its original characters appeared to be preserved practically unchanged.

" 6. A fifth strain which was made arsenic-resistant and passaged through guinea-pigs, partly by blood inoculation and partly by *G. morsitans*, behaved in exactly the same way as the corresponding normal variety, except that its acquired character of arsenic-resistance was maintained unimpaired.

" We were unable to obtain any support for the hypothesis that the rendering of a trypanosome arsenic-resistant interferes with its capacity to develop in Glossina." *W. Y.*

MURGATROYD (F.) & YORKE (Warrington). **Studies in Chemotherapy. XIV.—The Stability of Drug-Resistance in Trypanosomes.**—*Ann. Trop. Med. & Parasit.* 1937. Apr. 8. Vol. 31. No. 1. pp. 165–172.

In this paper the authors consider the duration of the acquired character of drug-resistance in trypanosomes. Two main problems were investigated: firstly, how long resistance to various drugs persisted in trypanosomes passaged through mice by blood inoculation, and, secondly, whether the resistance survived the developmental cycle of the trypanosome in Glossina. The following are the conclusions :—

" Resistance to the aromatic compounds of arsenic and antimony and to acriflavine is rapidly acquired by trypanosomes and persists indefinitely. A strain of *T. rhodesiense* made resistant to atoxyl in 1929, and subsequently passaged through mice by blood inoculation, has maintained unimpaired its resistant character for a period of 7½ years, during which the strain has passed through a series of 900 mice. Strains of *T. rhodesiense* made resistant to tryparsamide and to acriflavine respectively behaved similarly.

" Resistance to the aromatic arsenicals likewise survives unimpaired when the trypanosome is passed repeatedly through the natural intermediate host, Glossina. A strain of *T. brucei* made resistant to tryparsamide in 1932, and subsequently transmitted through guinea-pigs, partly by blood inoculation and partly by the tsetse-fly, has maintained unimpaired its resistant character for a period of 4 years, during which it has passed through 59 guinea-pigs and 4 times through *G. morsitans*.

" Resistance to Bayer 205 is developed very slowly and is gradually lost. A strain of *T. rhodesiense* was made resistant to this drug by repeated administration of subcurative doses to infected mice between May, 1931, and September, 1932. The resistant strain was then passaged through mice by blood inoculation. Within a year the resistant strain had lost at least 90 per cent. of its resistance, and within 4 years had lost all trace of resistance.

" Resistance to Bayer 205 survives at least one passage through *G. morsitans*. A tryparsamide-fast strain of *T. brucei* was made also resistant to Bayer 205 by the repeated administration of subcurative doses of the drug to a series of infected guinea-pigs over a period of a year. After the resistant strain had been passaged through a short series of

guinea-pigs it was passed through *G. morsitans*. Examination of the strain before and after transmission by *G. morsitans* showed that its Bayer 205-resistant character had survived the cyclical development of the trypanosome in the tsetse-fly."

W. Y.

MURGATROYD (F.) & YORKE (Warrington). **Studies in Chemotherapy. XV.—Observations on the Loss of Transmissibility by *Glossina morsitans* of *T. brucei* maintained in a European Laboratory.**—*Ann. Trop. Med. & Parasit.* 1937. Apr. 8. Vol. 31. No. 1. pp. 173–194.

In this paper the authors have analysed the data collected in their various experiments on the transmission of normal and arsenic-resistant varieties of *T. brucei* by *G. morsitans*, with a view to considering whether they throw any light on the mechanism whereby a strain of trypanosomes becomes non-transmissible by Glossina. They summarize their work as follows :—

" Evidence is produced that a strain of *T. brucei* isolated from wild *G. morsitans* in 1931, and subsequently maintained in Liverpool by passage through guinea-pigs, partly by blood inoculation and partly by *G. morsitans*, remained transmissible by the tsetse for at least 4 years, and then became non-transmissible.

" Analysis of the results of dissecting flies used in the transmission experiments showed that in about 90 per cent. of the cases in which the trypanosomes became established outside the peritrophic membrane the infection spread forwards to the proventriculus.

" In only about 20 per cent. of cases in which the proventriculus was involved were the salivary glands also invaded. This could not be explained on the hypothesis that the flies which exhibited only a ' gut + proventriculus ' infection had not lived long enough for the trypanosomes to reach the salivary glands. In all the instances in which it was possible to examine the point, the salivary glands had become infected by the 26th day or earlier. This observation agrees with the dictum of Duke that if the salivary glands are going to become invaded they will have done so before the 30th day after the infecting meal. Considerable numbers of flies were encountered in which proventricular infection had persisted long beyond this period without spreading forward to the salivary glands.

" In our experiments, therefore, establishment of the trypanosomes in the extraperitrophic space implied that in all probability the infection would reach the proventriculus ; but proventricular infection did not necessarily imply that the salivary glands would eventually become infected, as suggested by Taylor (1932).

" The stages by which our strain of *T. brucei* became non-transmissible appear to be, firstly, that the trypanosome lost the capacity to extend from the proventriculus to the salivary glands ; then, that it lost the capacity to extend forwards in the extraperitrophic space to the proventriculus ; and, lastly, that it lost the capacity of establishing itself in the extraperitrophic space."

W. Y.

NASH (T. A. M.). **Climate, the Vital Factor in the Ecology of *Glossina*.**—*Bull. Entom. Res.* 1937. Mar. Vol. 28. Pt. 1. pp. 75–127. With 7 figs. & 3 plates. [20 refs.]

In this long paper Nash first of all deals with the ecology of *G. submorsitans* and *G. tachinoides* in West Africa, and then he passes

to a comparison of the ecology of the East and West African races of *G. morsitans*. From 1927 to 1932 he worked on the ecology of *G. morsitans* at Kikori in Tanganyika, and from 1933 to 1936 he carried on his investigations on the ecology of *G. submorsitans* and *G. tachinoides* at Gadau in Northern Nigeria.

The author gives the following interesting summary of his work on *G. submorsitans* and *G. tachinoides* in West Africa :—

" *The Seasonal Factor.*

" 1. The period of stress due to extreme climatic conditions is far shorter in the forest than in the meadow-pan.

" 2. *G. tachinoides* is primarily dependent upon riverine vegetation or residual forest, and has only a very limited wet season spread. *G. submorsitans* is primarily an open woodland fly with great powers of dispersal which are annually checked by adverse climate that enforces a temporary dependence upon the riverine forests.

" 3. *G. tachinoides* abounds within the stream-bed or residual forest ; *G. submorsitans* abounds on the forest fringe.

" 4. The dispersal of both species is closely associated with evaporation and saturation deficiency. A mean monthly evaporation of 20–28 cc. and a saturation deficiency of 5 to 8 millibars results in maximal dispersal ; dispersal yields to concentration as the evaporative power of the air increases above these zones.

" 5. The extent of the annual dispersal is indirectly governed by the duration of the wet season—the longer the season the more extensive the dispersal.

" 6. The population of *G. submorsitans* steadily increases throughout the rains as the evaporation falls, and becomes maximal towards the end when the evaporation is in the optimum zone (20–25 cc.) ; density steadily falls throughout the dry season as evaporation rises, and becomes minimal at the end when evaporation is maximal. *G. tachinoides* is believed to behave similarly, but the optimum zone of evaporation is probably about 6 to 10 cc.

" 7. Adult longevity is primarily dependent upon maximum temperature ; it decreases as the temperature rises and increases as it falls. Longevity is greatest in the heavy rains and cold season when the mean monthly maximum temperatures are lowest, being between 85° and 90°F.

" 8. The frequent occurrence of maximum temperatures between 90° and 100°F. is believed to result in a shortened life, but no immediate fatalities occur until the maximum temperature enters the critical zone (*G. submorsitans* 103·5°–106°F. ; *G. tachinoides* 103°–105°F.).

" 9. *G. submorsitans* breeds during ten months of the year, and *G. tachinoides* during eleven months. Both species breed freely throughout a tremendous climatic range, the only cessation being in the heavy rains, when an almost saturated atmosphere appears to arrest reproduction.

" 10. In the early and mid-dry seasons *G. submorsitans* breeds primarily on the floor of small, isolated thickets throughout the open woodland, but in the late dry season it partly evacuates the thickets in favour of the residual forest ; it also uses rot-holes in trees growing in the thickets. *G. tachinoides* breeds extensively in small thickets in the early dry season, then it shifts to the residual forest, and finally, in the hot season, it moves to the moist sand of the river-bed ; it never uses rot-holes in trees.

" 11. *G. tachinoides* shifts its breeding-grounds as the evaporation rises ; the pregnant females probably evacuate a site when the soil has lost too much moisture. *G. submorsitans* is less sensitive, possibly because its puparia are more resistant to high temperature and low humidity.

" 12. From the middle of the early rains until breeding ceases in August, *G. submorsitans* breeds under logs in the woodland savannah, whilst *G. tachinoides* breeds under isolated trees on the forest margin.

" 13. Extensive breeding does not necessarily produce a large adult population ; the seasonal viability of the puparia has a more direct relationship to seasonal fly density than has the breeding rate.

" 14. The duration of the pupal period is directly related to the mean monthly temperature ; the period varies from an average of 41 days in the cold season, when the mean temperature is about 68°F., to only 18 days in the hot season, when the mean temperature is about 86°F.

" 15. Fly activity is closely associated with the temperature. Both species are completely inactive when the temperature is below 60°F. or above 105°F. Fly are most active between 81° and 85°F. ; hence in the heavy rains and cold season activity is maximal in the middle of the day, whereas in the hot season activity is then minimal. Tsetse seek to avoid excessive high temperature in the forest by becoming inactive near the ground-level where it is cooler.

" 16. Excessive evaporation, high maximum temperatures, and a great diurnal temperature range result in a greatly reduced fly population.

" 17. Locally the following conditions are optimal, but Gadau is near the hot, dry limit of the species' distribution :—*G. submorsitans* : Temperature constant at 79°F. with a saturation deficiency of 7 millibars ; 11 millibars probably results in a higher breeding rate (26°C. and 5 mm., or 8 mm. for breeding). *G. tachinoides* : Temperature constant at 77°F. with a saturation deficiency of 4 millibars ; 11 millibars probably results in increased breeding (25°C. and 3 mm., or 8 mm. for breeding).

" An attempt will now be made to co-ordinate the data upon the seasons which are favourable to the different fly functions with the ultimate size of the fly community.

" A large tsetse population can only be attained if the climatic conditions of the preceding months favour a progressive increase in the size of each generation. Growth of population must depend directly upon the following factors : (1) Parental longevity, (2) birth rate, (3) pupal period, (4) pupal mortality, (5) climatic conditions when offspring emerge.

" Clearly high parental longevity combined with a high birth rate and short pupal period will result in rapid breeding ; but factors 4 and 5 are the key factors, since high pupal mortality or unfavourable climatic conditions for the offspring can frustrate any efforts made to increase the population by factors 1 to 3.

" In the heavy rains even though factor 1 is optimal it is ineffectual because factor 2 is then minimal. In the early dry season factors 2, 3 and 4 are probably favourable but are ineffective because factor 5 is unfavourable. In the cold season factors 1 and 2 are almost optimal, but are cancelled out by the adverse effects of 3, 4 and 5. In the hot season both key factors (4 and 5) are most adverse. After the break of the early rains factors 2, 3 and 4 are favourable and 1 and 5 are becoming progressively better. By the end of the early rains (2½ months later) breeding has decreased considerably, but this is probably counteracted by all the other factors, which are nearly optimal ; in any case by this time the fly population has increased enormously.

" To summarise :—From the heavy rains onwards throughout the dry season insufficient factors are simultaneously favourable—factor is cancelling factor ; but in the early rains the factors essential to reproduction synchronize, and then as the rains progress the climate becomes steadily more favourable for the emerging offspring, culminating with optimum conditions in the heavy rains when density of population is greatest ; but the peak has then been reached, because the wet season cessation of

breeding is disastrous to the community, since no new generation emerges until well on into the unfavourable dry season.

" It has been shown that the vital functions of the fly are governed by quite different meteorological factors, and that the final result of these fly functions combined, as represented by the ultimate fly density, is related to the evaporation. This is understandable, as evaporation itself is a composite factor, and when evaporation is optimum, favourable medium temperatures and high humidities occur, and when evaporation is excessively high, unfavourable maximum temperatures and very low humidities are recorded ; further there is evidence to show that evaporation directly affects pupal mortality—a key factor. Evaporation epitomizes the individual meteorological factors in the same way that ultimate fly density summarises the final result of the vital fly factors.

" *The Food Factor.*

" 1. Both species are best fed in the late dry season and early rains when fly and game concentrate near the water. Tsetse are hungry in the heavy rains when floods and long grass cause the river-plain to be evacuated by most of the game ; hunger is greatest in the cold season when low temperature reduces the hours of activity.

" 2. Seasonal nutrition only depends directly upon climate in localities where the seasonal food supply ceases to be the dominant factor, thus permitting the influence of humidity on the hunger cycle to control the nutrition of the community.

" 3. Locally, the degree of hunger is never sufficient to affect the community materially ; fly showing signs of starvation are rare.

" 4. Unlike *G. submorsitans* females, the females of *G. tachinoides* readily attack man ; this species can thrive in isolated colonies surrounded by extensive cultivation, suggesting that it can subsist and reproduce almost entirely on human blood, and hence is a far more serious vector of sleeping sickness than *G. submorsitans*, which is only found in thinly populated areas where game animals still survive.

" 5. Females of both species attack man most readily in the seasons when game is scarcest.

" 6. *G. tachinoides* is always better fed than *G. submorsitans*, probably because of its ability to thrive on either mammalian or reptilian blood ; also, its sedentary habits keep it in the vicinity of the forest islands where game and reptiles are never entirely absent.

" The food factor is considered to be the least important of the three great factors that govern the existence of tsetse ; locally, food shortage has never been sufficiently pronounced to affect the community adversely. As in Tanganyika, fly density is highest when game is scarcest and lowest when game is most abundant ; climate is the vital factor, not food, which always suffices.

" *The Vegetation Factor.*

" 1. The residual forest islands provide the true habitat for both species ; they offer the fly protection when the climatic conditions elsewhere are insupportable, and provide suitable breeding-grounds and an adequate food supply ; further they are resistant to fire and flood.

" 2. The woodland savannah with its small thickets is the temporary habitat of *G. submorsitans*, and for many months in the year enables this species to spread and maintain itself at a considerable distance from the residual forest. To a much lesser extent this is true for *G. tachinoides*.

" 3. It is suggested that the term ' meadow-pan ' might be employed in the tsetse literature to replace the confusing collection of local native names that are at present used in describing this type of seasonal swamp.

" 4. Both species are most numerous and are best fed in the vicinity of the residual forest or true habitat. *G. submorsitans* lives mainly on the forest fringe, but *G. tachinoides* lives within.

" 5. Pronounced female centres and feeding-grounds of the East African type do not occur ; however, catches from the open country do show a higher female percentage and greater hunger. The higher the fly density the lower the female percentage.

" From an economic aspect there can be no doubt that vegetation is by far the most important factor ; we cannot alter the Nigerian climate, but by modification of the vegetation which forms the true habitat we may be able to modify the forest's micro-climates until they become incapable of befriending the tsetse in its time of need.

As a result of his ecological comparison of the East and West African races of *G. morsitans*, the author reaches the following conclusions :—

" 1. The small residual forest islands of N. Nigeria are analogous to the extensive *Berlinia-Brachystegia* woodlands of Tanganyika, in that both form the true habitat of *G. morsitans*.

" 2. In both countries extensive meadow-pan provides a thinly populated feeding-ground with a high female percentage, tsetse being hungrier there than elsewhere ; but in West Africa, dry season concentrations of hungry tsetse showing a high female percentage never form within small meadow-pans, such sites being uninhabitable at that season.

" 3. Females of both races attack man most readily where fly density is lowest, and least readily where the density of population is greatest.

" 4. The percentage of females emerging from thousands of puparia collected in the bush was 50 per cent. at Kikori and 51 per cent. at Gadau, but the average female percentage among fly that attacked man was only 11 per cent. in each fly-belt, suggesting that the females of neither race is partial to human blood.

" 5. Seasonal nutrition at Gadau is directly controlled by seasonal food-supply, and not by seasonal humidity as in Tanganyika. Since the influence of humidity upon hunger can be cancelled by pronounced seasonal fluctuations in the local food supply, the seasonal nutrition cycle is bound to vary throughout Africa.

" 6. At both Kikori and Gadau *G. morsitans* is scarcest when game is most abundant, indicating that the climatic factor controls fly density, not the food factor.

" 7. Both races are inactive in the early mornings of the cold season ; in view of results from extensive work in Nigeria, this inactivity is probably due to low temperature. The excessive heat of the West African late dry season causes pronounced mid-day inactivity, which was never observed in Tanganyika. Both races are normally inactive shortly after sunset.

" 8. Both races tend to attack man above knee height, unlike *G. tachinoides* which attacks the ankles.

" 9. As the evaporation rises throughout the dry season both races concentrate in their true habitats, but concentration is far more pronounced in N. Nigeria owing to the severer climate and the much smaller areas covered by the true habitat.

" 10. Both races disperse when the rains break and the evaporation falls, but the longer wet season in Tanganyika results in much more extensive dispersal, and the milder dry season that follows enables these advances to be consolidated, new fly-belts thus being formed. All attempts made at colonisation during the rains are annually checked in Nigeria by the severity of the following dry season.

" 11. In East Africa *G. morsitans* breeds primarily under fallen trees, but in West Africa it breeds promiscuously on the floor of thickets and forest islands—an adaptation to the climate, as shown by its reversion to logs in the few favourable weeks at the end of the early rains. Both races sometimes use rot-holes in trees, but such sites are only used in N. Nigeria if the trees grow within thickets.

" 12. Owing to the difference in breeding habits, log traps of the type that were very attractive to the East Africa race, are unattractive in N. Nigeria.

" 13. With the exception of the heavy rains, when breeding partly or completely stops, both races reproduce throughout the year. Breeding is maximal in the early rains, but is also considerable in the first half of the dry season, especially in East Africa.

" 14. *G. morsitans* can breed through a great range of climatic conditions; only very high humidity and low evaporation seem to affect reproduction.

" 15. In both races the duration of the pupal period depends upon the mean monthly temperature, being shortest in the hot months and longest in the cold. The variation at Kikori was 29–52 days, and at Gadau 19–41 days.

" 16. The density of the population of both races follows a seasonal cycle that is basically the same; density decreases in the dry season, becoming minimal towards the end; density starts to increase at the beginning of the rains, becoming maximal some months later. This density cycle is closely related to the seasonal saturation deficiency and evaporation.

" 17. When the mean monthly saturation deficiency is between 5 and 6 millibars and the mean evaporation is 20–25 cc., the population of both races is maximal; as the saturation deficiency and evaporation increase above or decrease below these optimum zones, so does the fly density decrease.

" 18. Providing that the mean saturation deficiency and evaporation are optimal, the population in a *G. morsitans* fly-belt will be maximal, irrespective of the mean temperature (within wide limits).

" 19. Since identical conditions of saturation deficiency and evaporation are associated with optimal conditions for both races, it is suggested that they are physiologically similar, and that their vital functions are governed by identical laws. This would account for the different nature of the true habitat selected by the West African race, which, having failed to adapt its constitution to the climate, has perforce adapted its habits; had it evolved a constitution which preferred a higher degree of evaporation and temperature, the greater frequency of optimum conditions would have enabled it to become as widespread a pest as its East African representative.

" 20. It is considered that optimum conditions for *G. morsitans* could be reproduced artificially by keeping the saturation deficiency at 6 millibars (4·5 mm.) with the temperature constant at 73°F. (22·8°C.), by raising the saturation deficiency breeding would be increased, possibly at the expense of the community."

W. Y.

Potts (W. H.). **The Distribution of Tsetse-Flies in Tanganyika Territory.**—*Bull. Entom. Res.* 1937. Mar. Vol. 28. Pt. 1. pp. 129–148. [46 refs.]

This paper gives information regarding the eight species of tsetse found in Tanganyika; they are *Glossina brevipalpis*, Newst., *G. longipennis*, Corti, *G. fuscipleuris*, Aust., *G. palpalis*, Rob-Desv., *G. morsitans*, Westw., *G. swynnertoni*, Aust., *G. pallidipes*, Aust., and *G. austeni*, Newst. *G. tachinoides*, *G. fusci* and *G. tabaniformis* have been recorded from the Territory, but these were undoubtedly mis-identifications, the first for *G. austeni* and the other two for *G. brevipalpis*.

The author considers that it is not very likely that any addition will be made to this list in the future, except that possibly *G. fusca* var. *congolensis* may be found along the western borders of the Territory.

Observations are recorded dealing with the distribution of each of these species, and these are followed by a brief account of the fly

belts of the Territory. They are eleven in all:—(1) The Great Western Belt, (2) the Musoma-Usukuma Belt, (3) The Eyasi-Mkalama Belt, (4) the Rift Valley Belt, (5) the Central Province Belt, (6) the Hika Belt, (7) the Masai Belt, (8) the Natron Belt, (9) the Pare-Usambara Belt, (10) the Great Eastern Belt and (11) the Rungwe Belt.

The paper concludes with an account of some natural features affecting the distribution of tsetse flies and with speculations regarding possible extensions of the fly-belts. The author summarizes his observations as follows:—

"1. Details are given of the distribution of the eight species of tsetse occurring in the Tanganyika Territory (*G. brevipalpis*, *G. longipennis*, *G. fuscipleuris*, *G. palpalis*, *G. morsitans*, *G. swynnertoni*, *G. pallidipes*, and *G. austeni*).

"2. The effect of past climatic changes on the present distribution of some of the species is discussed in a somewhat speculative manner.

"3. The detailed information is summarised in a general description and map of the fly-belts of the Territory.

"4. The effect of certain broad vegetation types and major topographical features on the distribution of species of tsetse in Tanganyika are discussed.

"5. The effect of the major topographical features in limiting the distribution of the fly is always found to reside in some accompanying vegetative or climatic feature.

"6. Possible and likely extensions of the fly-belts are briefly indicated; if these should take place, but little of Tanganyika Territory would remain uninfested by tsetse-fly. The possibility of natural retreat of fly-belts is also discussed.

"7. A few details are given of the habits and habitats of some of the lesser known species (*G. longipennis*, *G. fuscipleuris* and *G. austeni*)."

W. Y.

Jackson (C. H. N.). **Some New Methods in the Study of** *Glossina morsitans*.—Reprinted from *Proc. Zool. Soc.* London. 1936. Part 4. pp. 811–896. With 9 figs. & 12 plates. [26 refs.]

The author gives an account of ecological studies made during a period of over a year (ending December 1935) in a region in Tanganyika said to be typical of vast areas infested by the fly. The climatic records show a mean annual temperature of 23·8°C. (74·9°F.), with absolute limits of 35·6°C. (96°F.) and 6·1°C. (43°F.). The total rainfall for 1936 was 884 millimetres (34·8 ins.), and no rain at all fell between May and October. The country is "wooded, nearly flat and exceedingly monotonous," features which, with typical vegetation, are shown by several plates. During most of the period under consideration game was abundant.

The physiological state of the male flies caught at different times of year was studied. The author has now proved that the "hunger stages" which he previously described really do represent stages in the digestion of a blood meal, and he shows that several different workers (including one native) obtained almost identical results when they sorted the same collection of flies into hunger stages. These diagnoses of "hunger" by examining wild flies are well supported by chemical analyses. Results are given showing changes in the nutrition of the fly population at different seasons. The flies feed more frequently in hot dry weather than when it is cool and damp, and the author

states that the rapidity of onset of hunger may be correlated with the integrated saturation deficit, though he has not proved that dryness itself causes more rapid utilization of food.

A detailed investigation of the changes in numbers of the fly population in certain areas is described. The chief method was by releasing marked flies and noting the proportion of these in a large number of recaptures on a subsequent date. The methods described may be used for finding the number of flies in either an isolated colony or an area which is not "closed," and from which they are able to emigrate. The results are independent of activity as shown by the ordinary "fly round." Formulae given in this paper will enable other workers not only to measure the numbers of flies in an area, but also to find the standard error of the result. This is a considerable advance in ecological method.

In an area of 4·7 square kilometres (1·8 sq. miles) the fly population (males only) rose from 1,300 in February to 4,900 in July and then fell catastrophically to 1,200 in August. This fall appears to have been caused by emigration. A few experiments indicate that female flies probably live rather longer than males, but not many significant figures were obtained for that sex. As yet no clear-cut effects of climate on the fly numbers in the country as a whole have been shown, but further work on these lines seems bound to give enlightening results.

Finally the author suggests that there may be no "absolute density" of population of tsetse flies, above which they seriously compete with one another, for where there is sufficient food for a few flies there will be sufficient for a much greater number. Adverse factors such as enemies, climate, etc., will act equally against small and large fly populations. He suggests that density may be connected with "social habits."

Two points in this paper and in current work on tsetse call for comment. First, excessive attention is paid to the male part of the population. This may be unavoidable because few females approach man, but in tsetse as in human populations it is the number "females capable of producing offspring" that is all important. No doubt the workers themselves realize that it is time more methods were devised for studying the females. Secondly, papers of this kind are important to ecologists and insect physiologists in all countries, and they would be less difficult to understand if the results were given in the standard international manner. In the paper under consideration temperatures are given in Fahrenheit, rainfall in inches, evaporation in cubic centimetres, weights in milligrams and humidities (saturation deficiency) in millibars. It is surely better to use the Centigrade thermometer, though it may be useful at present to put in °F. as well. Humidity should be given either as saturation deficiencies expressed as millimetres of mercury, or else as relative humidity. Now that the East African Meteorological Service no longer uses millibars in its publications, the last excuse for the use of that unit in papers of this kind has disappeared. *Kenneth Mellanby.*

HARRISON (H.). **The Shinyanga Game Experiment: A Few of the Early Observations.**—*Jl. Animal Ecology.* 1936. Nov. Vol. 5. No. 2. pp. 271–293. With 5 figs. & 2 plates.

The general purpose of the experiments is explained in a foreword by Mr. SWYNNERTON. He puts forward the view that it is not

justifiable to undertake an indiscriminate slaughter of game animals as a way of controlling tsetse flies until we possess fuller information about the importance of different species of game as hosts of fly and trypanosome, and until other methods of control have been attempted. The present paper describes a carefully planned set of experiments and observations which are being undertaken on game animals in Tanganyika Territory.

The work is being carried out in several blocks of country, each of many square miles, in the neighbourhood of the tsetse laboratory at Shinyanga. The areas are already familiar to the entomologists, and a botanical survey of them is being carried out. The general plan is to treat the different blocks of country, which are isolated from one another by clearings, as different experimental areas. Some are to be left unmolested, or even rendered more attractive by providing water holes ; in others the game is to be continually harassed, but not killed ; in others again certain species of game animals are, as far as possible, to be exterminated. Throughout the experiment, the population of flies (*Glossina swynnertoni* principally) will be under continuous study by the method of " fly rounds." The experiments are planned to last a long time, but it is not quite clear from the text of the paper how far they have actually progressed. As a foundation the author sets out in considerable detail certain observations on 10 species of wild Ungulates. For each of these he defines, as far as possible, the food and habitat, breeding seasons, etc. *P. A. Buxton.*

Symes (C. B.) & McMahon (J. P.). **The Food of Tsetse-Flies (*Glossina swynnertoni* and *G. palpalis*) as determined by the Precipitin Test.**—*Bull. Entom. Res.* 1937. Mar. Vol. 28. Pt. 1. pp. 31–42.

The authors had originally intended to conduct an inquiry into the food of *G. palpalis* in various regions in Kenya, but after discussion with other workers it was agreed to extend the inquiry to other species from any part of East Africa. Their preliminary results, though mostly inconclusive, have narrowed the field of inquiry sufficiently to warrant a continuation of the work along very well-defined lines.

Sera were obtained from various sources. The animals dealt with were shot and bled into large sterile jars. The blood was allowed to clot overnight and the serum removed into sterile rubber-capped bottles. A small crystal of thymol was added to each bottle of serum, which was collected at any considerable distance from Nairobi. At the laboratory all the sera were filtered through a Seitz filter, put into ampoules, and stored in a refrigerator.

Young healthy rabbits were used for the preparation of all antisera.

In order to prepare the stomach contents of Glossina, the flies were killed by pressure of the thorax and allowed to dry. The authors state that obviously more exact results would be obtained by dissecting out the stomach from fresh flies. A certain loss resulted from the presence in many flies of an excess of fat, which rendered the stomach solution cloudy, and therefore unfit for accurate reading. Further loss probably occurred from continuation of digestive or bacterial action in stomachs after the flies were killed. The abdomen of each fly to be tested was ground up in the cell of a concave slide with ten drops of normal saline. This solution was allowed to stand for about an hour at room temperature, and was then centrifuged.

At the beginning of the work all stomachs were ground up and tested, but later, in order to conserve the antisera, only those stomach solutions showing a colour were tested.

The tests were carried out in capillary tubes as used for calf lymph. Antiserum was first drawn into the capillary for about a third of its length. This was followed by an equal amount of the stomach solution under test. Control tubes contained a mixture of stomach contents in normal saline. The tubes were allowed to stand for an hour at 37°C. and were then examined before an obliquely descending light with black background. Tubes showing definite flocculation or precipitation were recorded as positive.

A detailed account of the observations is given, and the authors summarize their results as follows :—

" 1. The main food hosts of *Glossina swynnertoni* in a district of Tanganyika appear to be (*a*) one or more Bovids, perhaps kudu or roan, exhibiting a close blood relationship to ox or buffalo ; (*b*) giraffe ; (*c*) pig. There is evidence that monkey or baboon is also made use of and that zebra definitely is not.

" 2. With regard to *G. palpalis* on Maboko Island, crocodile and hippopotamus are important hosts. But they are far less important than we had supposed. The majority of flies appear to have fed on some animal not yet determined."

W. Y.

Symes (C. B.) & Vane (R. T.). **The Eradication of *G. palpalis* from River Areas by the " Block " Method. (An Experiment Financed by the Colonial Development Fund.)**—61 pp. With 16 plates, 5 charts & 3 maps in pocket. 1937. Nairobi, Kenya Colony : Govt. Printer.

In Nyanza Province, Kenya, human trypanosomiasis is an important disease among the remaining population, and the presence of the vector, *Glossina palpalis*, prevents the most fertile land from being inhabited. The fly is found in the bush which fringes the lake and rivers ; the bush (and the fly) seldom extends more than a few hundred yards from the water. At present, infection takes place mainly at watering places and fords. Complete clearing of the bush would eradicate the fly, but this would be expensive, erosion and desiccation would occur, while wood, hut poles, etc., essential to the natives, would become unobtainable. This paper is an account of an attempt to free the bush from tsetse with the minimum clearing and the minimum expense.

The method found most practicable was to catch the adult flies by hand in nets. First riverine bush was divided into blocks 2 miles long by means of clearings about 1,000 yards wide. Then paths were made along each side of the river, and these paths were patrolled on several days a week by squads of natives with nets who caught as many flies as they could. In one block over 5,000 flies were caught between October and December 1933, while only 7 individuals were caught during the first 9 months of 1935. There was no corresponding reduction of flies in a control area in which flies were caught, counted and released. The cost of eliminating *G. palpalis* by hand-catching from one mile of riverine bush is about £40, while complete clearing costs £250. We do not yet know whether the bush is likely to become re-infested, but the cost of occasional patrols should be less than that of preventing regeneration of bush in ordinary clearings.

Traps captured a number of flies, but not sufficient to reduce the population very much, so that it is doubtful whether the present type of trap is of any practical use against riverine *G. palpalis*. In this area pupae were seldom found in accumulations in typical "pupa sites" and a very thorough search over an area of 12,000 square yards showed that the 84 living pupae found occurred in 57 scattered sites. Pupae appear to be deposited anywhere where there is moderate shade, and collection is too expensive to make this a practicable method of attack.

The work described in this paper has already opened up a considerable area which has been repopulated by natives who are growing crops of commercial value. The details which are given for all expenses (details which will be very useful to other workers) show that this method of eliminating the tsetse fly, under the particular conditions which exist in this part of Kenya, is one which is economically satisfactory. It is perhaps a pity that funds did not allow an entomologist to study the fly-population during the whole period, for this is the first case on record where the tsetse has been eliminated without the ecological factors in the environment being altered, and many interesting facts about the biology of the fly might have been discovered. The authors have, however, compiled and published much information and have obtained results of scientific as well as economic importance for a remarkably moderate expenditure.

Kenneth Mellanby.

Vicars-Harris (N. H.). *Glossina swynnertoni*, **Austen, in Relation to Various Vegetation Types.**—*Bull. Entom. Res.* 1936. Dec. Vol. 27. Pt. 4. pp. 533–557. With 18 figs.

Amply illustrated by means of graphs, an account is given of a preliminary investigation, by means of fly-rounds, into the relations between *G. swynnertoni* and vegetation in the Shinyanga and Maswa areas of Tanganyika Territory. Fifteen types of vegetation are differentiated, and graphs based on the catches of fly during periods of from one to nearly three years show "the apparent fly density in the different vegetation types at different seasons." In this respect there would seem to be definite evidence of seasonal preference on the part of *G. swynnertoni*, which, after a marked rainy season concentration in hard-pan, disperses and "spreads out more and more into the shadier or better-grassed types as the dry season arrives and progresses . . . . . Where the hard-pan is in immediate contact with extensive thickets or a strip of riverine forest this dispersal does not take place, but fly remains in that type of hard-pan, using, it is suggested, the thickets for breeding and resting." How far "these apparent vegetation preferences of the fly are connected with game movements and preferences" is not yet certain, but "Hunger does *not* appear to be a factor of prime importance influencing the fluctuations of apparent fly density in different vegetation types."

E. E. Austen.

Swynnerton (C. F. M.). **The Tsetse Flies of East Africa. A First Study of their Ecology, with a View to their Control.**

This book was reviewed on p. 363.

GRAF (H.). Ueber den Primäraffekt und die Inkubations zeit der Schlafkrankheit. [**On the Primary Lesion and Incubation Period of Sleeping Sickness.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1937. Feb. Vol. 41. No. 2. pp. 213–239. [44 refs.]

In this paper the author summarizes the literature dealing with the primary lesion in sleeping sickness and the related question of the incubation period. He also describes 7 observations made by himself, 4 of which have been previously recorded [this *Bulletin*, 1929, Vol. 26, p. 703].

The primary lesion in sleeping sickness is a furuncle-like swelling of the skin, which does not produce pus, and which appears soon after the bite of an infected Glossina. That such a swelling is due to the trypanosome, and not to inflammation resulting from the bite itself or to secondary infection, is proved by the discovery of large numbers of trypanosomes in the lesions, and by the fact that it is quickly cured by germanin.

The author has no doubt that the trypanosome chancre represents a tissue reaction to the injected trypanosomes, which multiply in the lymph spaces and then pass directly into the neighbouring lymphatic glands. A high virulence of the parasite and a low resistance of the host favours the development of the chancre. Very probably infection of the blood occurs simultaneously with the formation of the chancre, but, owing to the great volume of the blood, the parasites are found at an earlier date in the chancre. Reference to the phenomenon was fairly common in the pre-war literature, but between 1914 and 1929, when the author published his first paper on the subject, it had received little if any attention. Possibly the explanation of this is that the less pronounced trypanosome chancres, which probably constitute the majority, were easily overlooked by those who were ignorant of their existence. In late years, however, attention has been drawn to the phenomenon from various quarters. In 7 or 8 European cases seen by the author in the Cameroons there was a trypanosome chancre, and ZSCHUCKE did not fail to observe it in the 20 cases encountered by him in Fernando Po and the neighbouring mainland in which information on the point was available. The phenomenon has also been recorded from the Congo, Angola, Rhodesia, Nyasaland, Mozambique, and East Africa. It has been seen both in *gambiense* and *rhodesiense* cases. Graf states that, although there is no doubt that the primary chancre is absent in a definite percentage of European cases, he is quite sure that it is a by no means rare phenomenon, and that possibly future observations will show that it is exhibited by the average European case.

In well-marked cases the trypanosome chancre consists of a raised, indurated button-like area, dark red or violet red in colour and up to 10 cm. in diameter. The surrounding tissue is oedematous and it is sensitive to pressure and painful. In one of Graf's cases the lesion was as big as a 3-mark piece and felt like a button in the oedematous tissue ; the red centre was surrounded by a waxy halo and this in turn by a reddish zone : puncture of the waxy halo revealed the presence of numerous trypanosomes. This lesion is sometimes referred to as a pseudo-furuncle, because it does not suppurate. Whilst in pronounced cases the lesion is very characteristic, it is often little marked and takes the form of a small bluish-red indurated slightly raised area, which, however, can be distinguished from a non-infective bite because it is harder, more sharply demarcated, and persists for some days.

Well-marked primary lesions are always associated with severe general symptoms, which manifest themselves soon after the appearance of the lesion, *e.g.*, rigors, high temperature, marked asthenia and rapid emaciation; the neighbouring lymphatic glands quickly become enlarged and are sensitive and painful. When the primary lesion is but slightly developed the general symptoms are mild. A strongly pronounced primary lesion may last for many weeks, but reaches its maximum development in a few days. Slightly marked primary lesions last only a few days. Sometimes there may be several primary lesions. Occasionally the primary lesion can take the form of a painless ecchymosis or of a large purpuric spot. Non-infective tsetse bites are in general not followed by inflammatory reactions, but occasionally they cause itching swellings, which subside by the next day and are at most slightly coloured; they are not associated with general symptoms or with enlargement of lymph glands.

The incubation period of the disease shows considerable variations depending on the virulence of the parasite and the sensitiveness of the host. In those cases in which the disease sets in acutely shortly after the infection there is probably no difference between *gambiense* and *rhodesiense* infections, but prolonged latency is more common in the former. In cases which begin acutely the interval between the infective bite and the appearance of trypanosomes in the blood is, in Europeans, about 10 days; but when the primary lesion is very pronounced trypanosomes may appear in the peripheral blood within a week of its appearance. Even in negroes the disease may begin acutely within 14 days. The interval between the infecting bite and the development of the primary lesion was, in one well-marked case of the author's, 5 to 6 days, and in another case only 3 days. MARTIN and LEBOEUF (1908) describe 2 cases in which the lesion appeared on the evening of the day of the infecting bites.

In conclusion Graf emphasizes the importance of looking for these primary lesions, and points out that trypanosomes can be easily found in them and in the neighbouring glands some time before they can be discovered in the blood. *W. Y.*

COOKE (W. E.), GREGG (A. L.) & MANSON-BAHR (P. H.). **Recent Experiences of Mild or Symptomless Infections with *Trypanosoma gambiense* from the Gold Coast and Nigeria.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1937. Jan. 26. Vol. 30. No. 4. pp. 461–466. With 1 fig. [10 refs.]

The authors draw attention to the fact that for some time past particularly avirulent strains of *Trypanosoma gambiense* have been recorded from northern parts of West Africa and elsewhere. MACFIE (1913) recorded the existence of such a strain in Southern Nigeria, and on account of its low virulence he suggested that it should be separated as a distinct species under the name *T. nigeriense*. Manson-Bahr himself, over five years ago, stated that the virulence for Europeans of strains of *T. gambiense* in certain areas of the Gold Coast was becoming attenuated. Reference to similar mild strains of *T. gambiense* in Europeans infected in the Ivory Coast are to be found in the French literature, and VAN DEN BRANDEN has drawn attention to the existence of avirulent strains infected in the Belgian Congo. Avirulent strains of *T. rhodesiense* have also been mentioned by DAVEY (1908) and recently by LAMBORN and HOWAT (1936).

In the present paper the authors give details of three consecutive cases of West African trypanosomiasis of Europeans which have been diagnosed in 1929 in the ordinary routine of practice during the year, and of one earlier case. The detection of these cases was rendered possible only by the fact that the authors habitually make routine blood examinations of all their patients from West Africa. One patient showed no apparent evidence of disease and stated he felt quite well ; another was discovered to have on his shoulder a characteristic circinate rash, whilst the other two cases gave histories of fever while on the Coast.

Attention is drawn to the fact that in two cases the local reaction caused by the infected tsetse bite, the so-called trypanosome " chancre" (Graf, 1929) was still visible on careful examination, and that the blood infection was a particularly heavy one and therefore easily diagnosable. Details of the cases are given, and the results of blood inoculations into animals. Special attention is drawn to the vicarious appearance of trypanosomes in the peripheral blood of man, and to the lack of virulence of the organisms for laboratory animals.

W. Y.

Darré (H.), Mollaret (P.), Tanguy (Y.) & Mercier (P.). Hydrocéphalie congénitale par trypanosomiase héréditaire. Démonstration de la possibilité du passage transplacentaire dans l'espèce humaine. [**Congenital Hydrocephalus in Hereditary Trypanosomiasis. Demonstration of the Possibility of Transplacental Passage in the Human Being.**]—*Bull. Soc. Path. Exot.* 1937. Feb. 10. Vol. 30. No. 2. pp. 159–166 ; 166–176. With 2 figs. [34 refs.]

These papers give very interesting details regarding an instance of hereditary trypanosomiasis. The child was born at Marseilles on 22nd February, 1934. The birth was perfectly normal, but the accoucheur's attention was immediately drawn to two points—firstly the small weight of the baby, and secondly the abnormal size of its head. Three weeks later the mother noticed an intense dilation of the superficial veins of the head. In April 1934, the child began to suffer from attacks of fever. A diagnosis of congenital syphilis was made and antisyphilitic treatment given. The child continued to exhibit an undulant type of fever until 3rd November, 1935, when a lumbar puncture was performed ; the fluid was clear, albumen 0·40, leucocytes 55, Wassermann negative. Further antisyphilitic treatment was given without result.

The child was again admitted to the Pasteur Hospital on 4th December, 1935. Signs of hydrocephalus predominated. On 25th January, 1936, another lumbar puncture gave the following results—albumen 0·50, cells 120, Wassermann negative. It was then decided to search carefully for trypanosomes. On 2nd February, 1936, a lumbar puncture was made, the fluid centrifuged, and the deposit examined microscopically ; trypanosomes were found and various laboratory animals infected. The parasite had the characters of *T. gambiense*. Treatment with tryparsamide was attended with excellent results.

In the second paper the authors gave a medical history of the mother of this child. The parents had spent 32 months in the Tchad district and had remained in good health except perhaps for malaria. The

wife became pregnant and decided to return to France in October, 1933, when she was 5 months pregnant. Before reaching the coast she had an attack of fever which was considered to be malaria ; a second attack of fever, which occurred when she was on the ship on the way to France, was accompanied by a circinate erythema. The voyage ended without further trouble and the child was born at term in Marseilles. Two months later there was a further attack of fever and this also was accompanied by a rash similar to the former. She was seen by a number of doctors, who, in view of the state of the child, considered the case to be one of syphilis. Further fever occurred during the year, but it was not until February 1935, that trypanosomes were found and the true diagnosis made.

The authors next describe in great detail the journey the patient made from Tchad to the coast, and reached the conclusion that she was probably infected on the Chari some time between 23rd October and 4th December, 1933. The patient was treated and apparently cured with tryparsamide. *W. Y.*

CALWELL (H. G.). **The Pathology of the Brain in Rhodesian Trypanosomiasis.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1937. Apr. 19. Vol. 30. No. 6. pp. 611–624. With 16 figs. on 4 plates. [15 refs.]

The pathological lesions described in this paper are based on the examination of the brains of 17 cases of *rhodesiense* trypanosomiasis in Africans. The brains were removed entire ; incisions were made into the lateral ventricles and these were kept open by cotton wool, and the whole brain immersed in 10 per cent. formol-saline. For histological examination pieces were taken from the frontal, parietal and occipital cortex, the subcortical white matter, the corpus callosum, basal ganglia, mid-brain, pons, medulla, cerebellum and choroid plexuses.

Clinical details and the post-mortem findings are given of each of the 17 cases. For the most part the only clinical evidence of involvement of the central nervous system was the abnormal condition of the cerebrospinal fluid. Many of the patients were insufficiently treated.

It is recorded that MOTT (1906) found a chronic leptomeningitis in sections of the cortex, base of the brain, the cerebellum and the spinal cord from cases of *T. gambiense* infection. He examined 21 brains and found that the meningitis was markedly basal in three, pneumococcal in one and purulent in one. MARTIN and DARRÉ (1909) found that the meningitis in 4 cases of Gambian trypanosomiasis chiefly affected the vertex of the cerebral hemispheres. In the author's 17 cases only one exhibited macroscopic basal meningitis ; there was one pneumococcal. With this exception the meningitis was always on top and hardly ever extended more than half way down the sides of the hemisphere. Calwell never saw meningeal adhesions at the base of the brain. Microscopically, however, there was generalized leptomeningitis. The intensity of the cell infiltration varied from brain to brain and from area to area. The pia arachnoid was infiltrated with small round cells, lymphocytes, polymorphonuclear cells and morular cells. In 10 of Calwell's cases lumbar puncture had been done during life, but the intensity of the meningitis in any given case was not reflected in the condition of the spinal fluid.

The perivascular infiltration, as seen by Calwell, consisted in a proliferation of the vascular endothelium and packing of the Virchow-Robin space with lymphocytes, plasma cells, glia cells and morular cells. The Virchow-Robin space is the continuation of the subarachnoid space formed by the reflection of the pia mater along each blood vessel which enters the nervous tissue. It can be traced along the larger arteries and veins to the arterioles and venules, but has not been demonstrated around the capillaries (Biggart, 1936). In 14 of Calwell's cases perivascular infiltrations were abundant, and in the remaining 3 they were scanty.

Mott (1906) gave the name morular cells to certain large round or oval cells with a deep staining nucleus pushed up to one pole, and the cytoplasm consisting of clear spherules giving the cells a mulberry appearance ; he thought they were degenerate plasma cells. Perruzi (1928) concluded that the morular cells have a multiple origin in trypanosomal encephalitis, but that the neuroglia is their most frequent origin. Mackie (1935) found these cells most frequently in the cellular exudate of the pia mater ; he also found them in the perivascular cuffs and in the brain substance not obviously in connexion with blood channels. Mackie refutes the view that their origin is invariably nerve cells as he encountered them sometimes outside the nervous system. Calwell found morular cells in all the brains of his series ; they were abundant in 11 and scanty in 6 cases. He discovered them in every part of the brain, except the choroid plexuses.

The choroid plexuses were examined in 8 cases. They were normal in only one brain, and in this patient the spinal fluid a month before death contained 333 cells per cmm. ; the protein was 0·028 per cent. In the other cases Calwell found round cell infiltration, fibrosis, fibrinous exudate and oedema. In 3 cases many round bodies like corpora amylacea about 70μ in diameter were seen. These bodies, which are due to degeneration of parenchymatous tissue, are commonly found in asylum practice in the brains of old people.

There was an increase in glia cells in the neighbourhood of vessels, especially those which had infiltrations round them. Calwell found no changes in the neurones. He examined 14 brains for demyelinization and found evidence of it in eleven cases. The areas of demyelinization were all perivascular and were very small, but could be found by the low power of the microscope. Such areas were most common in the subcortical white matter, next in the medulla and pons, and least in the cerebellum. Trypanosomes were not found in any part of the brain. *W. Y.*

Sicé (A.) & Bonnet (P.). Contribution à l'étude des variations de l'équilibre protéique du sérum sanguin au cours de la trypanosomiase humaine. [**Contribution to the Study of the Variations of Protein Equilibrium in Blood Serum during Human Trypanosomiasis.**]—*Marseille-Méd.* 1936. Dec. 25. Vol. 73. No. 36. pp. 707–712.

This paper describes the authors' observations on the quantitative changes in the two heat coagulable proteins of the serum—serum-albumen and serum-globulin—which occurred during the course of sleeping sickness. The serum-globulin was considered as a whole, and no attempt was made to divide it into its various fractions, *viz.*, euglobulins, pseudo-globulins, etc. Patients in various stages of the

disease were selected for the investigation. The methods used for estimating the proteins are described, and observations were made on ten patients.

Previous work by various authors has shown that the total protein in the serum of normal human beings varies between about 77·8 gm. to 80·5 gm. per litre. The quantity of serum-albumen is greater than that of serum-globulin. EPSTEIN gives the value of the former as 46·6 gm., and ACHARD gives the serum-albumen as 45 to 55 gm. and the globulin as 25 to 35 gm.

The authors' work on sleeping sickness cases showed that as the disease progresses, there is an increase in total quantity of protein, and this is the more marked as organic lesions are the more pronounced; thus, with one exception, the quantity of serum-protein exceeded 100 gm. per litre in all the cases in which the cerebrospinal system was involved. This increase in total protein was chiefly due to increase in the serum-globulin, which in one case reached as much as 75·8 gm. per litre. The amount of serum-albumen just as frequently falls below normal as rises above it. In sleeping sickness, therefore, there is a breakdown of the equilibrium of the two serum proteins, the ratio of the amount of globulin to that of albumen rising considerably.

W. Y.

MILLOUS. Le traitement de la maladie du sommeil au Cameroun. [**Treatment of Sleeping Sickness in the Cameroons.**]—*Ann. de Méd. et de Pharm. Colon.* 1936. Oct.–Nov.–Dec. Vol. 34. No. 4. pp. 966–995.

This paper reviews the work done on the therapy of sleeping sickness in the Cameroons.

Dealing first with treatment in the field, the author points out that commencing in 1908, atoxyl was employed. It resulted in a peripheral sterilization of 50 per cent. of cases, but, as 40 per cent. relapsed, the total cures were only 10 per cent. in heavily infected districts. In places where the endemic index was slight the results were better. Then came tartar emetic, but this was soon abandoned as unsatisfactory. Tryparsamide followed, but, owing to its moderate trypanocidal activity, it became reserved for second stage cases. Up to 1932 the general rule was atoxyl for first stage cases and tryparsamide for those in the second stage; moranyl was only used for old positive cases.

Lumbar puncture was rarely performed in the field before 1932 but, owing to the work of LEDENTU, it became extensively practised during the latter part of that year. In the third portion of 1932 the number of lumbar punctures made were 2,556, whilst in 1933 the number rose to 23,323. The treatment then adopted was a series of 12 weekly injections of orsanine for first stage cases, and tryparsamide, preceded by 2 injections of orsanine, for second stage cases. [Orsanine, or 270 Fourneau, is o-oxy-p-acetylamino-phenyl arsinic acid; see this *Bulletin*, 1932, Vol. 29, p. 640; 1935, Vol. 32, p. 386.]

According to LEDENTU, patients should be kept under observation for 4 years, and then it is possible in the 5th year to declare cured those who for 4 years have not shewn trypanosomes in the peripheral circulation and whose cerebrospinal fluid has remained normal during that period.

In 1934 moranyl began to be used systematically in the Cameroons. The use of tryparsamide then became reserved for patients in a bad stage in whom sterilizing doses of orsanine and moranyl would be dangerous, and as a sort of treatment of preservation. Orsanine, either alone or with moranyl, became the main treatment of the disease. Orsanine, however, in the classical doses of 0·02 gm. per kilo. does not give the success which was originally hoped for. BONNET, for example, obtained only 5 (31 per cent.) permanent cures out of 16 cases. RICHE and TRINQUIER used larger doses of 0·025–0·03 gm. per kilo., and obtained only 32 per cent. of relapses out of 124 cases so treated.

Hospital treatment.—Having found that orsanine in doses of 0·02 gm. per kilo. did not give sufficiently good results, BONNET increased the dose to 0·03 gm. intravenously. Apparently, patients tolerated such doses well and the accidents were almost negligible. The results of this method of treatment were very good, BONNET obtaining 95 per cent. of successes among old cases and 87 per cent. among new cases. It is difficult to understand why the old cases, many of whom had previously been treated with other drugs, should give better results than the new cases. As MILLOUS observes, arsenic-resistance could not have played any part here. Whatever be the explanation, the fact remains that with all patients in the first stage of the disease 92·6 per cent. of successes were obtained. These successes can often be considered to be cures, because of the 228 patients treated, 109 have been re-examined 6 to 9 months after the end of treatment and blood and spinal fluid found to be normal. Even when the spinal fluid is changed orsanine often gives good results. BONNET treated 78 such patients, and 80 per cent. of new cases and 67 per cent. of old cases showed improvement.

MONTALIEU employed a still larger dose of 0·04 gm. of orsanine per kilo., but gave the drug subcutaneously. Of 237 cases treated in this way, all except 6 were sterilized. But before large doses of orsanine are given it is necessary by careful examination in hospital to make sure that the patient is in good general condition. Both BONNET and MONTALIEU have shown that treatment with orsanine almost always results in considerable loss of weight.

Relapses may occur in the course of treatment or after the end of the course. BONNET states that sometimes there may be a relapse in the second and third week of treatment, or sometimes about the eighth week : these relapses are usually transient and the trypanosomes disappear without any modification of the treatment. More frequently, however, the relapses occur during the fourth or fifth week and the trypanosomes tend to persist in the blood. In order to deal with this it is necessary either to increase the dose of orsanine or to have recourse to moranyl. Those who exhibit no relapse during the full course of 12 weekly injections are probably cured ; but in the case of those who exhibit one or more relapses at least 10 injections should be given after the last relapse. Patients who have relapsed after the tenth or twelfth injection have been given 20 to 22 injections without any trouble.

After-treatment.—At the conclusion of treatment the blood should be examined every 3 days for a period of a month. BONNET observed 13 relapses (5·7 per cent.) among his 228 cases. Immediately on the discovery of trypanosomes, treatment should be started again. Sterilization is easily produced and BONNET has observed only two

transient relapses during the second course of treatment. MONTALIEU, however, recommends changing the drug for moranyl more quickly.

If the examinations are negative the patient is examined occasionally up to the end of the third month, and if the spinal fluid is normal they are examined every 6 months until they can be declared to be cured. In 90 per cent. of cases the single course of treatment suffices to cure and all subsequent therapy is useless.

With regard to patients in the second stage of the disease, and in this class the author groups together with those who show changes in the spinal fluid, all in bad general condition, Millous writes that orsanine must be used with care. Many such cases show a progressive loss of weight when treated with this drug, and in this event it should be immediately replaced by tryparsamide and moranyl.

BONNET gives 0·03 gm. of tryparsamide and 0·0075 gm. of moranyl per kilo. of body weight each week for a period of 12 weeks. MONTALIEU uses rather larger doses, *viz.*, 0·05 gm. of tryparsamide and 0·01 gm. of moranyl. The results are good, but whichever method is employed there remains a number of cases who are not sterilized. Those who have resisted all attempts at medicinal therapy may be treated with the blood of a convalescent case. The blood donor should be a recent patient who has made a rapid recovery. Details are given regarding 2 groups of very advanced cases treated by this method (one intramuscular injection of blood every alternate day) ; the results in certain cases seemed to be encouraging.

The use of these pentavalent arsenicals was not unattended with accidents. Even orsanine in large doses must be given with caution and to people under observation in hospital. After the first injection nausea and headache are not uncommon ; in 40 per cent. of the cases the nausea was followed by vomiting, conjunctival congestion, slowing of the pulse, and intense supra-orbital pain. These symptoms are not aggravated by the second dose and, as a rule, disappear two days after it. Among severe accidents have been noted—one case of grave icterus commencing 36 hours after a relatively small initial dose of 1·4 gm. in a 59 kilo. patient ; one case of vomiting with bloody diarrhoea ; and one case of exfoliative dermatitis. The most numerous accidents are visual and these may follow either tryparsamide or orsanine. Stress is laid on the value of intravenous injections of 20 per cent. sodium hyposulphite in these conditions.

The paper concludes with a consideration of the length of time and number of observations which are necessary before one is justified in declaring a patient to be cured. *W. Y.*

VAMOS (S.). Traitement de trypanosomés dans un secteur du Moyen-Chari (A. E. F.). Etude de 3,705 observations. [**Treatment of Trypanosomiasis in a Sector of Moyen-Chari (A.E.F.). Study of 3,705 Observations.**]—*Bull. Soc. Path. Exot.* 1936. Nov. 18. Vol. 29. No. 9. pp. 1015–1022.

The author reviews the results obtained from the usual methods of treatment of sleeping sickness in the bush during the period which he spent in the highly endemic region of Chari-Logone.

Between 1919 and the beginning of 1935 some 5,222 cases of sleeping sickness have been discovered. Of this number, 943 have been found too recently to be dealt with here ; 95 have died from other diseases,

and 479 have died from unknown cause. If these cases be disregarded, there remain 3,705 which have been followed carefully.

Patients diagnosed in the first period.—These comprised 2,029, all of which had a normal spinal fluid at the time of first puncture. Of these, 1,172 are considered to be cured after an observation of 5 to 10 years: they were treated with atoxyl, or rarely orsanine, in the bush during the usual medical tours. Other first stage cases have exhibited after one or more years of observation a changed spinal fluid; 34 cases fall into this category and apparently all of them were cured with tryparsamide. Still other cases, 484 in number, have not shown any sign of nervous involvement, but so far they have only been observed for 1 to 4 years; probably the great majority will prove to be cured. The cerebrospinal fluid of 242 cases has become pathological after one to several years of treatment with atoxyl; they are still under treatment and it is too early to judge the result. Thus of the 2,029 first stage cases, 276 have, notwithstanding atoxyl (or orsanine) treatment, passed into the nervous stage; 51 exhibited the first signs of nervous disease one year after diagnosis, 88 two years afterwards, 97 three years afterwards, 29 four years afterwards, and 11 five years afterwards. The author states that probably the last 11 cases, which lived in heavily infected regions, were really the result of re-infections. So far 65 cases have developed nervous trouble and have resisted treatment with tryparsamide. The number of deaths recorded amongst these 2,029 first stage cases is 32.

Patients diagnosed in the second period.—These number 1,676 and all exhibited a pathological spinal fluid at the first puncture. After preliminary doses of atoxyl or orsanine they have been treated with tryparsamide. The number of injections has not been limited to the arbitrary "standard cure" of 12 doses annually, as this was found in many cases to be insufficient. Of these 1,676 cases, 58 have been declared cured and 706 are still under observation and periodic treatment; cases are only regarded as cured if their spinal fluid has been normal for at least 5 to 6 consecutive years; 134 had a normal spinal fluid for a year, 79 for two years, 237 for three years, 155 for four years and 159 for five years [these figures include the 58 considered to be definitely cured]. The treatment has been less satisfactory in 334 cases; of these, 48 were complete failures, 140 had several relapses, 29 relapsed after a year of improvement, 20 after two years' improvement, 51 after three years', 25 after four years' and 22 after five years or more of improvement. The number of deaths recorded is 413, together with 165 others who were in a bad condition when seen and to whom tryparsamide was not given.

The results of all this work are summarized in a table from which it is seen that the percentage of failures among the 2,029 first stage cases was 1·75 and that of the deaths 0·9. Among the 1,676 second stage cases the percentage of failures was 9·01, and that of deaths 15·6.

W. Y.

KUNERT (Herbert). Arzneimittelwirkung bei *Trypanosoma brucei*. [**The Action of Drugs on** *T. brucei*.]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Dec. 31. Vol. 89. No. 6. pp. 431–434.

The trypanosome with which Kunert worked was a strain of *T. brucei* brought to Berlin from Tanganyika in infected Glossina in October, 1932. It was maintained in mice, and when the present

experiments began it had reached the 302nd passage. Kunert examined the action of a large number of compounds (dyes, aromatic arsenicals, various antimonials and naganol) on infected mice. He finds that his results differ from those of previous workers who have used old laboratory strains of *T. brucei*, and draws the conclusion that the results of experiments on old strains have little significance for practice in the tropics. *W. Y.*

Schern (Kurt) & Artagaveytia-Allende (Ricardo). Die glykoprive Therapie der experimentellen Trypanosomeninfektion mit Anticoman. [**The Hypoglycaemia Therapy of Experimental Trypanosomiasis by Anticoman.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Dec. 31. Vol. 89. No. 6. pp. 484–487.

In continuation of their work on the therapeutic action in trypanosomal infections of substances which produce hypoglycaemia [this *Bulletin*, 1937, Vol. 34, p. 132] the authors have tried "anticoman" which is less toxic than synthalin. Rubino and others have shown that synthalin has a toxic action on the liver, kidneys and pancreas, producing fatty degeneration. According to Staub the toxicity of synthalin depends upon lactic acid formation—and Gessner has shown that Synthalin B produced twice as much, and guanidin 17 times as much lactic acid as synthalin itself.

Tablets of anticoman contain :—

0·0077 gm. of dekamethylenediguanidin bitartrate.
0·1023 gm. of pancreas ferment powder.
0·0200 gm. of sodium phosphate.
0·0200 gm. of tannic acid.
0·0250 gm. of bismuth subnitrate.

It has been shown that rabbits will tolerate large doses of anticoman without toxic effects. Experiments are described showing that anticoman will cure mice infected with *T. equinum*. *W. Y.*

Collier (W. A.). & Verhoog (M. J.). Ueber Arsen-Detoxin-Verbindungen. [**On Arsenic-Detoxin Compounds.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1937. Feb. 20. Vol. 90. No. 1. pp. 43–57.

The authors have continued their work on the therapeutic action of a series of compounds consisting of the condensation productions of oxy-amino- and oxy-amino-phenyl arsenoxides and their substitution products with high molecular keratin hydrolysates [this *Bulletin*, 1936, Vol. 33, p. 192]. In the course of their work another compound, designated "As XIII," was discovered to have exceptionally favourable properties. On nagana-infected mice it was found to have a therapeutic index of 1 : 66·6 to 1 : 80, when given subcutaneously, and 1 : 10 when given by the mouth. On *Sp. recurrentis* infections in mice its therapeutic index was 1 : 3·3 to 1 : 5 when given subcutaneously. The curative action was quicker than that of neosalvarsan.

The resistance of a salvarsan-fast strain of nagana to the various arsenic-detoxin compounds was found to vary ; the resistance to some of the compounds was greater than to salvarsan, while to other compounds it was less. It was found that both in infected mice and rabbits a series of a number of minute doses gave even better results than a single large dose. *W. Y.*

Mercier (H.) & Soulage. Note au sujet de l'utilisation de la pyretothérapie dans la trypanosomiase au stade encéphalo-méningé. [**Pyretotherapy in the Encephalo-Meningeal Stage of Trypanosomiasis.**]—*Marseille-Méd.* 1936. Dec. 25. Vol. 73. No. 36. pp. 701–706.

The object of this note is to draw attention to the possible value of pyretotherapy in a sleeping sickness patient exhibiting meningeal symptoms after the usual treatment with tryparsamide. The authors point out that it is not their aim to question the therapeutic value of tryparsamide, but to utilize, after the drug has done all that it can do, a measure which has proved of value in comparable affections of the central nervous system. Details are given of the clinical history of a patient in whom this method was tried with apparently beneficial results. *W. Y.*

Schilling (Claus). Versuche zur Immunisierung gegen Trypanosomenkrankheiten. VII. Teil. [**Experiments on Immunization against Tsetse Disease.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Dec. 7. Vol. 89. No. 5. pp. 306–311.

It was observed that young calves in the first weeks of life exhibited a considerable resistance to *T. congolense*, *T. brucei* and *T. vivax*. This resistance can be enhanced either by the method of minimal infection or by the injection of dried trypanosome vaccine. These experiments, which, in Schilling's opinion, indicate the direction which future work should take, were brought to an end by the author's departure from Africa. *W. Y.*

Schilling (Claus) with H. Schreck, H. Neumann & H. Kunert. Versuche zur Schutzimpfung gegen Tsetse-Krankheit. VI. Teil. [**Experiments on Immunization against Tsetse Disease.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Dec. 7. Vol. 89. No. 5. pp. 279–295. With 21 figs.

In this paper the author describes further isolated observations bearing on this matter. Attempts to immunize kids by the injection of dried *T. rhodesiense* were not very satisfactory, as the animals suffered from intercurrent infection.

A number of chemotherapeutic observations were made. Treatment of large animals infected with *T. brucei* or *T. congolense* by the bites of infective flies rarely resulted in cure. A very interesting experiment in a horse infected with *T. brucei* and cured by old salvarsan and 5 intramuscular injections of trixidin (antimony trioxide in oil) showed that shortly after the cure the existing antibodies may disappear from the blood. It was noticed that a strain of *T. congolense*, which was curable by Surfen (6678) in 1930, had, after 116 mouse passages, developed a certain degree of Surfen-resistance.

Experiments were undertaken to ascertain how soon after the infective bite trypanosomes could be demonstrated in the blood of the vertebrate. Flies were fed on two calves and 18 and 24 hours later 20 cc. of their blood was injected into monkeys ; the monkeys became infected, thus showing that the calves had trypanosomes in the peripheral blood 18 hours after the infective bite.

The question of the development of trypanosomes in Glossina is discussed in some detail, but without any addition to knowledge

except for one very interesting observation. Whilst dissecting a number of flies one was found with a heavy infection of the proboscis and gut ; unfortunately, only one of the salivary glands was obtained and this was free from trypanosomes. During the attempt to discover the other salivary gland a thread of tissue was withdrawn from the thorax ; this thread did not contain blood and was not salivary gland or duct. What exactly it was is not clear, but the interesting discovery was made that it contained countless long developmental trypanosome forms. From this Schilling concludes that perhaps trypanosomes may develop in other organs than the gut and salivary glands. [Possibly the thread may have been the duct of the sucking stomach.] The developmental forms of the various species of trypanosome in Glossina are described ; these are figured, as are also certain curious forms, the significance of which is uncertain.

It was observed that the repeated intravenous injection into a horse of a dead trypanosome suspension from rat blood may produce a fatal anaphylactic shock. The kid of an infected mother was not infected, but its blood contained antibodies. *W. Y.*

Lourie (E. M.) & O'Connor (R. J.). **The Dissociation of Antibody from Sensitized Trypanosomes.**—*Ann. Trop. Med. & Parasit.* 1936. Dec. 23. Vol. 30. No. 4. pp. 541–544.

In this note the authors explain a phenomenon to which reference is made in their previous communication [this *Bulletin*, 1937, Vol. 34, p. 123]. They have succeeded in demonstrating that antibody which is bound to trypanosomes dissociates when the sensitized trypanosomes are allowed to stand in the absence of complement ; and that the dissociation takes place much more quickly at 37°C. than at room temperature (17°–19°C.). *W. Y.*

Patel (Chhotu). Ueber die physikalische und chemische Beeinflussbarkeit von Trypanosomen im Hinblick auf das Vorkommen abgeschwächter Erregerstämme. [**The Production of Attenuated Strains of Trypanosomes by Physical and Chemical Influences.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Dec. 7. Vol. 89. No. 5. pp. 325–361. With 2 figs. [25 refs.]

After giving a summary of previous work on this subject the author passes to an account of his own experiments on the influence of various physical factors on trypanosomes. As he was in a position at the Freiburg Skin Clinic to study all kinds of rays under exact conditions, he began his investigation by examining the effect of Röntgen rays and ultraviolet rays on trypanosome suspensions. He found that there was a remarkable difference in the dose of these rays necessary to produce the same result. Enormous doses of Röntgen rays produced no morphological changes and no loss of virulence, whilst minimal ultraviolet radiation proved fatal. Exposure of the trypanosome suspension to the direct rays of the sun for 20 minutes proved fatal, but trypanosomes exposed to the rays for 10 to 15 minutes infected mice in much the same way as the control suspension.

Laveran and Mesnil showed long ago that trypanosomes were very sensitive to high temperatures ; they were quickly killed at 42°C.–43°C., but they survived for 3 hours at 40°C. and for 1 hour at 42°C. In contrast Patel found that a temperature of 37°C.–38°C.

for 30 minutes killed the trypanosomes. He is unable to explain this remarkable difference. [In all probability it lies in the nature of the suspension. The reviewer and his colleagues have shown that a trypanosome suspension can be kept undamaged for much more than 24 hours at 37°C. If the medium in which the trypanosomes are suspended is unsuitable—either in respect of protein or glucose content—the parasites die quickly at 37°C. and even at considerably lower temperatures. Probably this criticism applies to all Patel's *in vitro* experiments.] The trypanosomes withstand low temperatures better; exposure at 0°C. for 90 minutes does not destroy their infectivity.

The galvanic stream in minimal doses destroys the trypanosomes. A long series of experiments were conducted to ascertain the effect of various concentrations of sodium chloride. Exposure to a solution of 0·3 per cent. NaCl for an hour did not affect the motility or the virulence of the parasite; they also survived exposure to 0·2 per cent. NaCl for 20 minutes, and to 5·0 per cent. for up to 30 minutes. Other experiments dealt with the action of acids and alkalies.

The paper closes with certain observations on the action of salvarsan and parafuchsin on infected mice and rabbits. *W. Y.*

Bovet (D.) & Montezin (G.). Sur l'aptitude remarquable que possèdent différents médicaments arsenicaux à produire des races de trypanosomes résistants. [**The Remarkable Capacity possessed by Various Arsenicals to produce Resistant Strains of Trypanosomes.**]—*Bull. Soc. Path. Exot.* 1937. Jan. 13. Vol. 30. No. 1. pp. 68–75.

After giving a brief summary of recent work on drug-resistance, the authors state that they propose to record experiments dealing with the problem how drug-resistance is established and with the aptitude of different aromatic arsenicals to produce resistant strains of trypanosomes.

Yorke and his colleagues have shown that strains of trypanosomes made resistant to atoxyl, arsacetin, tryparsamide, halarsol, novarsenobenzol, stibenyl, and trypaflavine, respectively, are not only resistant to the compound used to provoke resistance, but also equally resistant to all the other commonly employed aromatic compounds of arsenic and antimony and to trypaflavine.

The authors have examined the question of the speed with which various aromatic arsenicals produce resistant strains. In their work they have used atoxyl, orsanine, tryparsamide, Fourneau 189 (3 amino-4-oxy-phenylarsinic acid) and also two other compounds described by Fourneau, *viz.* F.683 (hydroxymethyl-3-amino-4-phenylarsinic acid) and F.722 (hydroxy-2-hydroxymethyl-4-phenylarsinic acid). Their technique was as follows:—Mice infected with an old laboratory strain of *T. brucei* (Mesnil) were treated with a half or a third of the curative dose of the drug to be examined, so that a relapse occurred between the 5th and 10th day after treatment. The relapse trypanosomes were then inoculated into a series of mice and the minimum curative dose of the drug used, and also of orsanine, determined.

Details are given of an experiment which showed that a single dose of atoxyl (1 mgm. per 20 gm. mouse) failed to produce any recognizable degree of resistance on the part of the trypanosome either to atoxyl or

to orsanine. Another experiment, however, shows that a single dose of F.683 (10 mgm. per 20 gm. mouse) produced great resistance both to F.683 and to orsanine. It was finally shown that whereas a single dose of orsanine, F.189, and tryparsamide failed, like a single dose of atoxyl, to produce any resistance, a single dose of F.722 produced great resistance like a single dose of F.683.

In a table the minimum effective dose and the minimum toxic dose of each of the drugs used are given. The authors conclude that different drugs, closely related chemically, exhibit very different aptitudes to provoke arsenic-resistance. The production of resistance is not proportional to the amount of the arsenical injected, nor to the arsenic content of the drug. *W. Y.*

Launoy (L.). Le pouvoir infectieux du sang chez les souris infectées par "*Trypanosoma congolense*" et traitées par le 205–309 [Moranyl]. [**The Infective Power of the Blood of Mice infected with** *T. congolense* **and treated by Moranyl.**]—*Bull. Acad. Méd.* 1936. Dec. 22. 100th Year. 3rd Ser. Vol. 116. No. 40. pp. 867–870.

Moranyl in large doses clears the blood of mice infected with *T. congolense*, but about 90 per cent. of the animals relapse in 5 to 7 days. The question the author has attempted to solve is whether the blood in the negative period is really sterile. He refers to the previous work of Nicolle, who showed that after a dose of 4 mgm. per 20 gm. of mouse infected with *T. congolense*, microscopic examination of the blood was negative from the 23rd hour to the 5th day, and that subinoculation of the blood into normal mice failed to produce infection between the 31st hour and the 3rd day. Nicolle also sought to ascertain in which organs the surviving parasites took refuge, but in this he failed [this *Bulletin*, 1933, Vol. 30, p. 790].

Launoy assembles in a table numerous similar experiments performed by himself between May 1933, and November 1936. His infected mice were all treated with 5 mgm. per 20 gm. of moranyl; and at various intervals afterwards, varying from 15 hours to 120 hours, normal mice were injected intravenously or intraperitoneally with the heart blood of the treated animals. The table shows that the subinoculations made 45 hours after treatment were all negative, whereas those done before and after this period always gave a number of positive results. Broadly speaking, the percentage of positive inoculations increased as the distance from 45 hours increased; thus all the inoculations done between the 15th and 23rd hours were positive, as were almost all those done between the 87th and 120th hours. *W. Y.*

Ströder (Josef). Ueber die Beeinflussung einer experimentellen Trypanosomeninfektion durch Begleitinfektionen. [**The Influence of Concomitant Infections on Trypanosome Infections.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1936. Nov. 3. Vol. 89. No. 3/4. pp. 161–177. [37 refs.]

After giving a brief summary of the observations of previous workers on the influence of concomitant infections on the course of trypanosomal infections, Ströder describes certain experiments performed by himself. He used both mice and rabbits infected with the Braun-Teichmann strain of trypanosomes; as concomitant infections the

author employed either *Spirillum morsus muris* (Sodoku) or *Sp. recurrentis*.

It was found that Sodoku exerted no influence on the course of the trypanosome infection in mice (intraperitoneal inoculation) or on that of rabbits (subscrotal inoculation). The trypanosomal infection was influenced by superinfection with *Sp. recurrentis*, but only when the latter infection was given when the trypanosomes in the blood were scanty. When mice suffering from the primary attack of relapsing fever were superinfected with trypanosomes, the latter infection was inhibited so long as the spirochaetes were present in the blood.

W. Y.

v. Vásárhelyi (J.). Besteht ein Parallelismus zwischen der trypanoziden und der spirochätoziden Wirkung der Arsenobenzolpräparate ? [**Is there a Parallelism between the Trypanocidal and Spirochaeticidal Action of Arsenobenzol Compounds ?**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1937. Feb. 20. Vol. 90. No. 1. pp. 19–28. [20 refs.]

The author examined the therapeutic activity of two arsenobenzol preparations on experimental syphilis of rabbits, the trypanocidal activity of one of these substances (Preparation B) was only 60 per cent. of that of the other (Preparation A). The experiments showed that the substance which had the weaker trypanocidal action had also a weaker action in rabbit syphilis. *W. Y.*

Mellanby (Kenneth). **Experimental Work with the Tsetse-Fly, *Glossina palpalis*, in Uganda.**—*Bull. Entom. Res.* 1936. Dec. Vol. 27. Pt. 4. pp. 611–632. With 2 figs. & 1 plate. [14 refs.]

An account is given of laboratory experiments made with *G. palpalis*, dealing mainly with the effects of climatic conditions, temperature and humidity in particular, and on the metabolism and life cycle. The work was done in 1935–1936 at the Human Trypanosomiasis Institute, Entebbe, and also during visits to tsetse areas in Kenya and Tanganyika. The following summary is given :—

" The general conclusion arrived at after examining the results obtained by subjecting *Glossina palpalis* to different humidities is that though excessive desiccation is harmful, yet the fly is able to withstand far drier conditions than it is ever likely to meet in the field. It appears unlikely that, for instance, the seasonal fluctuations in numbers round Lake Victoria are due to harmful effects of the dry season. There is also no evidence that very moist air is itself harmful.

" Experiments to determine the time flies could survive without food under various conditions of temperature and humidity showed that the rate at which water is lost is fairly slow, so that except in very dry air flies die from starvation before desiccation proves fatal.

" Breeding in the laboratory is unsatisfactory, because of difficulties in persuading flies to feed regularly.

" The readiness with which flies feed, and the amount of blood which they take, is not affected by humidity.

" The rate of metabolism is the same in dry and moist air. In dry air water is lost more rapidly than in moist, which upsets the dry-matter : water ratio, but a blood meal contains so large an excess of water that it can replace any deficiency. It is possible to show that *G. palpalis* exhibits a regular hunger cycle, in which the hungry fly has an empty gut and a small fat-body. Two days or so after feeding the gut is nearly empty, and the

fat-body is at its maximum size. Then the fat decreases and the fly becomes hungry once more. It is only when the air is very dry that death occurs from desiccation before the fat has all been metabolised (when normally the fly becomes hungry and seeks food). *G. palpalis* can withstand one hour at 41°C. in moist air, and can cool itself by evaporation sufficiently to withstand 42°C. in dry air. It can withstand 39°C. for 3 hours in air of all humidities. These temperatures are above those occurring within its normal range.

" It is possible to see living sperm in the spermatheca of a fertilised female tsetse. Even in the presence of males, females in laboratory cultures may avoid fertilisation for many weeks. The process of copulation is described. The presence of a high proportion of males does not cause abortion, for pregnant females are not persistently pestered.

" Flies are not active, nor do they seek for food even if hungry, at temperatures below 21°C. Between 21° and 13°C. they can fly if disturbed, and between 13° and 8°C. they crawl or kick. Below 8°C. they are completely immobilised, though even after 3 hours at that temperature they can feed within 2 minutes of transference to 25°C.

" Hungry flies are more active than those which are not. Increased light intensity and a raised temperature promote activity. Flies seem to be attracted by light, and there is an optimum light intensity, which is about a third the intensity of sunlight.

" Pupae develop best in moist air. In fairly dry air adults are unable to escape from the puparia. In all places where I found wild pupae, the air in the soil spaces was saturated, though the soil appeared to be dry.

" The active larvae show no reaction to light."

W. Y.

MELLANBY (Helen). **Experimental Work on Reproduction in the Tsetse Fly,** *Glossina palpalis.*—*Parasitology.* 1937. Jan. Vol. 29. No. 1. pp. 131–141. With 2 figs. [10 refs.]

The object of the work described in this paper was to ascertain the effect of temperature, humidity and nutrition on the reproductive cycle of the female *G. palpalis*. The author summarizes her observations as follows :—

" 1. The reproductive cycle of the female fly was worked out at an average temperature of 24°C. The lowest egg of the right ovary develops first, and is ripe in 7 days. Ovulation never occurs earlier than the 8th day, and frequently later ; it bears some relation to fertilization, for eggs in virgin females failed to ovulate for weeks. The first larva was produced in a variable time after fertilization (because of delayed ovulation), but the succeeding larvae were produced very regularly, with an average period of 9·9 days between them.

" 2. Pupae produced in the laboratory usually weigh less than those collected in the field. The reason for this is nutritional, and flies must take large meals at the right stage in gestation to produce large pupae. It is impossible to ensure that this happens with all flies in the laboratory.

" 3. Abortions are caused in captivity by flies obtaining too little blood. They may be induced in pregnant females by allowing them to take only small meals, when either an egg or a small larva is extruded. When these flies were properly fed later, they produced normal larvae.

" 4. A constant temperature of 30°C. causes sterility in females. Ovaries develop abnormally, embryos fail to hatch from eggs, but young larvae (in the uteri) are not adversely affected.

" 5. A constant temperature below 22°C. slows down the rate of development of the eggs in the ovaries and lengthens the larval period. Experiments at this temperature are complicated by inactivity of males, which leave many females unfertilized. The length of the combined embryonic and larval periods is 17½ days.

" 6. Experiments performed outside in the laboratory compound suggest that the period between each larva in the field (during December in Uganda) will be about 13½ days (min. temp. 16°C. ; max. temp. 27°C.).

" 7. Flies appear to be able to breed equally well with relative humidities of 47, 88 and 100 per cent. In the drier air care must be taken with feeding, or the flies die from desiccation.

" 8. A temperature of 20°C. can cause pregnant females to retain their larvae for an extra 12 hours, but not longer."

W. Y.

MELLANBY (Kenneth). **The Reproductive Cycle in** *Glossina morsitans* **and** *Glossina swynnertoni*.—*Parasitology*. 1937. Jan. Vol. 29. No. 1. p. 142.

During a visit to Tanganyika the author was able to investigate the reproductive cycles of *Glossina morsitans* and *G. swynnertoni* and compare them with the cycle in *G. palpalis*. After comparing his results with those of Mrs. H. N. MELLANBY on *G. palpalis*, the author writes :—

" The main significance of these results is that these three different species should behave almost identically ; it is therefore probable that all species of tsetse have a similar reproductive cycle. This information may be of some importance in assisting field investigations of the reproduction of the various species."

W. Y.

CORSON (J. F.). **Experimental Transmission of** *Trypanosoma gambiense* **by** *Glossina morsitans* **through Monkeys.**—*Ann. Trop. Med. & Parasit.* 1936. Dec. 23. Vol. 30. No. 4. pp. 389–400.

Corson considers here the question whether the characters of a trypanosome can be modified by passing it through a species of Glossina other than that which naturally transmits it. STEPHENS and FANTHAM (1910), when describing *T. rhodesiense*, wrote that possibly it might be a variety of *T. gambiense* due to some change of environment, and that its peculiar morphology might be the result of its having been conveyed by species of Glossina other than *G. palpalis*. The only experimental evidence in support of the idea that *T. rhodesiense* has been produced by the passage of *T. gambiense* through a species of Glossina other than *G. palpalis* is that given by KLEINE (1928), who wrote : " Moreover, W. Fisher (1913), on Lake Tanganyika, reported to me on the strikingly rapid death of monkeys which he had infected there by means of *G. morsitans* with *T. gambiense*. I regret that we did not pay more attention to these experiments." LESTER (1935) transmitted a strain of human trypanosomes through a series of 25 *G. tachinoides*, and the same strain in a parallel experiment, through a series of 7 *G. submorsitans* and found no significant difference between the trypanosomes of the two series of transmissions. At least 10 years ago it was recommended that *T. gambiense* should be transmitted repeatedly by *G. morsitans* and *T. rhodesiense* by *G. palpalis*.

In July 1934, Corson received from Entebbe a strain of *T. gambiense* in a monkey and two guineapigs. The monkey had been infected by *G. palpalis* in April 1934, from another monkey which had been infected from a case of sleeping sickness on March 15th, 1934. The strain had been found at Entebbe to have a low virulence and infectivity, and was not easily transmitted there, inoculation of monkeys

sometimes failing to infect them. Transmission by *G. morsitans* was begun about the middle of September 1934, and was continued from monkey to monkey by boxes of flies without any attempt to isolate the infective flies. The series of transmissions by flies is shown in a plan, from which it appears that the experiments lasted from September 1934, until May 1936, and that the trypanosome was transmitted in this way through a series of 8 monkeys (*Cercopithecus* sp.). Details of the course of the infection in the various monkeys and of the results of inoculations into laboratory animals are given in a number of tables. So far as could be judged no increase in virulence took place during the eight passages. *W. Y.*

Corson (J. F.). **Are Experiments with Trypanosomes in Laboratories in Tropical Africa vitiated by Accidental Infections ?**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. Nov. 28. Vol. 30. No. 3. pp. 309–312.

In this article Corson considers the question whether in tropical Africa animals kept for use in experiments for trypanosomes may fail to be reliable owing to their being accidentally infected with trypanosomes. Two possibilities seem to exist. Firstly, that native oxen, sheep, goats, dogs, fowls and wild animals may have a chronic infection caused by the bites of wild tsetse flies in areas in which they have lived for some time, and that the chronic infection may escape detection. Antelopes, unless they are born on the laboratory premises or in some other place situated many miles from tsetse flies, cannot be regarded as free from a natural infection, and this applies especially to the more resistant kinds in which infection may be hard to detect.

The second cause of error may be mechanical infection. In laboratories where *Tabanidae* and *Stomoxys* are at times plentiful, as at Tinde, the question of mechanical infection requires consideration.

After reviewing his own observations on this matter Corson concludes :—

"It seems that confidence may be placed in the trustworthiness of experiments with human trypanosomes in laboratories in tropical Africa if they are situated in open country several miles from wild tsetse flies, and if tsetse flies are not repeatedly introduced by trains or motor cars. At the present time, however, with the establishment of aerial transport, much of the work which had to be done formerly in sleeping sickness areas of tropical Africa, can be carried out in places where no fear of accidental infection by biting flies need be entertained."

W. Y.

Iriarte (David R.). Contribución al estudio de la enfermedad de Chagas en Venezuela. [**Study of Chagas's Disease in Venezuela.**]—*Gac. Méd. de Caracas.* 1936. May 31, June 15, 30 & July 15. Vol. 43. Nos. 10, 11, 12 & 13. pp. 149–159 ; 161–170 ; 183–189 ; 194–206. With 44 figs. [79 refs.]

This article, or series of articles, does not permit of abstract. It deals with several aspects of the subject : the correct nomenclature of the parasite, whether Schizotrypanum or Trypanosoma, description of cases, acute and chronic, and their pathological histology, also of

animals inoculated and their electrocardiographic tracings, xeno-diagnosis, and the insect transmitters. The following summarizes the author's main conclusions :—

1. Chagas's disease is as much an endemic infection in Venezuela as malaria and ankylostomiasis and more serious because treatment is not satisfactory.

2. Many of the patients from the plains suffering from cardiac affections are probably instances of this disease since they do not respond to the usual treatment of cardiac conditions.

3. In certain parts of the country the percentage of infected insects (*Rhodnius*) was very high ; of 24 collections from different districts some showed as many as 60 per cent. positive.

4. The author thinks that Schizotrypanum should stand rather than Trypanosoma as the generic name of the parasite.

5. In Zaraza, where the percentage of positive *Rhodnius* was so high, examination of 12 boys living in straw huts and also of the blood of " a few domestic animals " failed to reveal any positive cases.

6. A patient giving a positive W.R. and Kahn reaction, with cardiopathy ascribed to syphilis, having died, his heart was examined and leishmanial forms were found in the myocardium.

7. Four species of Reduviid bug are found in the country : *Eutriatoma maculata*, *Rhodnius prolixus*, *Panstrongylus geniculatus* and *Spiniger rubropictus*. The first is very common, but was not found infected in nature nor could it be infected experimentally. The chief transmitter is *Rhodnius prolixus*. *H. H. S.*

Mazza (Salvador) & Benitez (Clemente). Segundo caso de forma aguda de enfermedad de Chagas comprobado en Corientes. [**Second Acute Case of Chagas's Disease in Corrientes.**]—*Universidad Buenos Aires : Misión de Estudios de Patología Regional Argentina Jujuy*. 1936. Publicación No. 28. pp. 13–22. With 9 figs.

The patient was a well-built man of 18 years presenting marked oedema of the lids of the left eye with enlargement of the corresponding glands and also some exophthalmos and granulations on the tarsal conjunctiva of the lower lid. The authors were particularly struck by the condition they describe as dacryo-adenitis [inflammation of lachrymal gland] which was marked and persistent, being still noticeable 3 months after the onset of symptoms. *H. H. S.*

Mazza (Salvador), Idelsohn (Francisco) & Parcerisa (Pedro J.). Segundo caso de forma aguda benigna de enfermedad de Chagas comprobado en Entre Ríos.—*Universidad Buenos Aires : Misión de Estudios de Patología Regional Argentina Jujuy*. 1936. Publicación No. 28. pp. 23–28. With 4 figs.

Mazza (Salvador) & Castro Rendón (Eduardo). Comprobación de forma aguda benigna de enfermedad de Chagas en Neuquén.—*Universidad Buenos Aires : Misión de Estudios de Patología Regional Argentina Jujuy*. 1937. Publicación No. 30. pp. 3–4.

Dios (R. L.), de Sommerville (E. T. W.), Bonacci (H.) & Aldao (J. F. A.). Indices de infestación del *Triatoma infestans* en la R. Argentina. [**Proportions of *Triatoma infestans* found infected in Different Districts of the Argentine.**]—*Rev. Inst. Bacteriológ.* Buenos Aires. 1936. Nov. Vol. 8. No. 1. pp. 13–141. With 13 maps & 4 graphs. [7 pages of refs.]

It is impossible to abstract this long article; those who are interested must consult the original. The question is an important one because the prevalence of Chagas's disease is not known with any certainty and the determination of those places in which infected Triatoma are found affords presumptive evidence that human infection may be expected to occur. The authors have examined over 30,000 specimens, male and female, imago, nymph and larva. They cut the posterior extremity, then press out the internal organs by means of a needle from before backwards, dissect them on a slide, stain by Papenheim's method and examine. They note the parasitic prevalence in the different provinces and deal with each separately, stating the districts where infected bugs have been found and the stage of development. A small subsection deals with xenodiagnosis. The whole is well documented, over 400 references are appended.

H. H. S.

Mazza (Salvador), Montaña (Armando), Benítez (Clemente) & Janzi (Edim Z.). Transmisión del *Schizotrypanum cruzi*, al niño por leche de la madre con enfermedad de Chagas. [**Transmission of Infection of *T. cruzi* to an Infant by the Mother's Milk.**]—*Universidad Buenos Aires: Misión de Estudios de Patología Regional Argentina Jujuy*. 1936. Publicación No. 28. pp. 41–46. With 1 fig.

Nattan Larrier in 1913 demonstrated that *T. cruzi* might be found in the milk of women experimentally infected.

The present paper gives an account of a woman of 30 years, living in Makallé (Chaco), who in January 1936, showed symptoms of Chagas's disease. Two months later she was confined; no parasites could be seen in the child's blood when 10 days later they left Makallé for Resistencia (Corrientes) where they have since lived. Eleven weeks later, mother and daughter were again examined. The blood of the latter contained many trypanosomes, there had been diarrhoea, and enlarged glands, the size of maize grains, at the occiput and in neck, axillae and groins, with enlargement of liver and spleen and a rapid unequal pulse; no swelling of lids, or cutaneous lesions found anywhere. In Resistencia the vector of *T. cruzi* is not seen. Examination of the mother's milk on the same day discovered three *T. cruzi* in the centrifuged deposit, and again 6 days later, though none was seen in thick blood drops.

H. H. S.

Olle (Rodolfo G.). Síntomas oculares de la enfermedad de Chagas. Su significación diagnóstica. [**The Diagnostic Value of Ocular Symptoms in Chagas's Disease.**]—*Universidad Buenos Aires: Misión de Estudios de Patología Regional Argentina Jujuy*. 1937. Publicación No. 30. pp. 30–49. With 7 figs. [28 refs.]

The author gives details of nine cases of Chagas's disease in which swelling of one eye (occasionally both) occurred as an early symptom

and sufficiently characteristic to be of diagnostic value. The condition goes by the name of Trypanosomal unilateral conjunctivitis (conjunctivitis schizotripanósica unilateral) and has the following characters:—

1. Starts abruptly with swelling of lids and conjunctiva and disappears slowly.
2. There is painless oedema, of reddish-violet colour.
3. Injection of conjunctiva may amount to chemosis.
4. The swelling extends to the face.
5. Corneal affection is absent.
6. Conjunctival secretion is scanty.
7. Preauricular, parotid or submaxillary gland of the same side usually enlarged.

In a table of findings, the swelling appeared earliest on the sixth day of disease [at least that was the day on which examination was made] and the trypanosome was found by direct examination of the blood ten days later. The illustrations show the condition as clearly as any uncoloured photograph can. *H. H. S.*

Mazza (Salvador) & Benítez (Clemente). Investigaciones sobre la enfermedad de Chagas. I. Comprobación de la naturaleza esquizotripanósica y frecuencia de la dacrioadenitis en la enfermedad de Chagas. Presencia de granulaciones tarsales en la forma ocular de esta enfermedad. [**The Trypanosomal Nature of the Dacryoadenitis in Chagas's Disease.**]—*Universidad Buenos Aires: Misión de Estudios de Patología Regional Argentina Jujuy.* 1937. Publicación No. 31. pp. 1–31. With 31 figs.

This article is based on a study of eight cases of Chagas's disease presenting the early ocular symptoms; five were shown to have the trypanosomes in their blood, three were confirmed by a positive Machado reaction. Histological examination showed sparse granulations over the lower tarsal conjunctiva with giant-cells, and the trypanosomal nature was proved by finding leishmania forms in the deeper parts. Photomicrographs demonstrate the changes set up.

H. H. S.

Mazza (Salvador) & Olle (Rodolfo). Particularidades de dos casos de enfermedad de Chagas. [**Two Cases of Chagas's Disease with Unusual Symptoms.**]—*Universidad Buenos Aires: Misión de Estudios de Patología Regional Argentina Jujuy.* 1936. Publicación No. 28. pp. 1–12. With 12 figs.

The authors remark that Chagas has described cases of American trypanosomiasis with ocular complications, even to secondary panophthalmitis with suppuration and total destruction of the eye. The two here described were not so serious as that, but presented ocular symptoms not usually observed.

The first was a girl of 5 years, who showed a painless oedema of both lids of the left eye, no suppuration, but slight exophthalmos with a convergent squint "not paralytic, all the ocular movements being maintained." No other ocular abnormality except a slight congestion of the conjunctiva was detected. Trypanosomes, though scarce, were seen in thick drops of the peripheral blood. The spleen was enlarged "appreciably." Three and a-half months after the onset

parasites were no longer seen in the blood, but the spleen was still enlarged and the liver now also. There was no exophthalmos and the strabismus was transient only and at intervals. In another fortnight all signs had disappeared.

The second patient was a man of 33 years whose initial symptoms of headache and general pains had led to a diagnosis of influenza, but 4 days later marked oedema of the lids of the left eye appeared with disturbance of vision, but no pain. The spleen was " enlarged appreciably and could be felt below the costal margin." A swollen pre-auricular gland was excised, and showed marked histiocytic hyperplasia, these cells containing many leishmania forms ; the gland cells appeared little if at all affected. The symptoms cleared up in about 5 weeks. It is noted that the general disturbance preceded by fully 10 days the onset of the ocular symptoms. *H. H. S.*

Couto (Miguel), Jr. Lesões do sistema especifico do miocardio num caso de tripanozomiase americana. [**Myocardial Lesions in American Trypanosomiasis.**]—*Hospital.* Rio de Janeiro. 1936. Nov. 8th Year. Vol. 2. No. 11. pp. 1223–1227. With 4 figs.

The author gives a general sketch of the cardiac arhythmias which may occur in Chagas's disease and describes briefly an illustrative case in his own practice. This was a young man of 18 years from a part of Minas infested with Triatoma. When first examined he presented a bradycardia, 46 per minute, and occasional extrasystoles. Later [how long afterwards is not stated] heart-block became more manifest and the Stokes-Adams syndrome appeared, 28 pulsations per minute. Two years after he had first come under the author's care he suddenly complained of violent pain in the heart, and was dyspnoeic, exhibiting the symptoms of infarct of the heart and death occurred soon after. Sphygmographic tracings are reproduced in the paper. *H. H. S.*

Mazza (Salvador), Romaña (Cecilio) & Parma (Bartolome). Caso agudo de enfermedad de Chagas con lesión cutánea de inoculación.—*Universidad Buenos Aires : Misión de Estudios de Patología Regional Argentina Jujuy.* 1936. Publicación No. 28. pp. 29–33. With 2 figs.

Mazza (Salvador), Romaña (Cecilio) & Zambra (Eduardo R.). Comprobación de lesión cutánea de inoculación en un caso de enfermedad de Chagas.—*Universidad Buenos Aires : Misión de Estudios de Patología Regional Argentina Jujuy.* 1936. Publicación No. 28. pp. 34–40. With 7 figs.

Mazza (Salvador), Benitez (Clemente) & Benitez (Jose). Diagnóstico retrospectivo de enfermedad de Chagas, forma aguda, por examen anatomopatológico de ganglio axilar.—*Universidad Buenos Aires : Misión de Estudios de Patología Regional Argentina Jujuy.* 1936. Publicación No. 28. pp. 47–53. With 7 figs.

Bonne (C.). Over de Crithidiën van *Triatoma rubrofasciata* de Geer. [**Crithidia of** *Triatoma rubrofasciata.*]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1936. Sept. 29. Vol. 76. No. 39. pp. 2483–2486.

In a previous paper the author has shown that the flagellates of the crithidia type which occur commonly in the intestine of *Triatoma*

rubrofasciata produce a trypanosome infection when inoculated to mice. It may be difficult, however, to see the trypanosome in the blood of the infected mice but clean bugs fed on the mice readily become infected (the xenodiagnostic method of diagnosis of BRUMPT). Attempts were made to find the real vertebrate host of the bug flagellate. Bugs were fed on rats infected with *Trypanosoma lewisi* but no infection resulted. However, bugs fed on one rat, the blood of which showed no trypanosomes on microscopic examination, acquired an infection indistinguishable from the naturally occurring flagellate infection. These flagellates inoculated into mice gave rise to a trypanosome infection like that produced by the naturally occurring bug flagellate. By the method of xenodiagnosis two other rats were found to be infected, though blood examinations were negative. In view of MALAMOS' discovery in a monkey of a trypanosome of the *T. cruzi* type bugs were fed on man and monkeys with the hope of revealing some hidden infection of the *T. cruzi* type, but with negative results. The author concludes that the naturally occurring flagellate in *Triatoma rubrofasciata* is not *T. cruzi*, as the trypanosomes which appear in mice are not of the *T. cruzi* type, while developmental forms in the tissues like those associated with *T. cruzi* infections in mice are not found.

C. M. Wenyon.

LEISHMANIASIS.

GIRAUD (Paul). Epidémiologie du kala-azar dans la région marseillaise. [**Epidemiology of Kala Azar in the Marseilles District.**]—*Marseille-Méd.* 1936. July 25. Vol. 73. No. 21. pp. 81–92.

Writing of kala azar in the district of Marseilles, the author notes that the disease became apparent in 1922, since when about 146 cases have been recorded, of which 135 were autochthonous. Of the 146 cases, 5 were in adults and 4 in adolescents, the rest being in children. The endemic area does not extend west of the Rhone, while to the east it is continuous with other endemic foci up to the Italian border. In a northern direction 100 kilometres is its limit. In the Marseilles region particularly the dry, scrubby districts are those most affected and it is in these regions also that "fièvre boutonneuse" is most common. This disease is admittedly conveyed from dog to human being by the tick, and the author thinks that a similar mode of infection may occur in the case of kala azar. He puts aside any idea of direct contagion from case to case and, though admitting that sandflies are common in the kala azar districts, he observes that they are by no means limited to or most abundant there. Furthermore they feed upon adults as well as children, which is not the case with dog ticks, which readily attack the children of the poor who, in these areas, live most of their young days out of doors and in close contact with the ground. The author admits that proof of tick transmission has not yet been obtained, but he thinks that further work on the subject should be carried out. It appears that the incidence of infection in dogs is very high and that they are to be regarded as reservoirs of the leishmania infection. In fact the disease in dogs came to light in this district some years before human cases began to be discovered. *C. M. Wenyon.*

D'OELSNITZ. Le kala-azar autochtone de l'adulte. [**Autochthonous Kala Azar in the Adult.**]—*Bull. Acad. Méd.* 1936. Oct. 13. 100th Year. Vol. 116. No. 30. pp. 207–209.

During the past fifteen years the author has seen over a hundred cases of kala azar in children in a certain section of the Mediterranean littoral of France. In the same period fifteen cases in adults have been observed and of these twelve were certainly autochthonous. The disease has presented the usual features. The author advocates sternal puncture for the preparation of bone marrow smears as a diagnostic procedure preferable to and more reliable than other methods. *C. M. W.*

ARCHIBALD (Robert G.) & MANSOUR (Hasseeb). **Some Observations on the Epidemiology of Kala-Azar in the Sudan.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1937. Jan. 26. Vol. 30. No. 4. pp. 395–400.

The author has already given a preliminary account of his investigations in another publication (this *Bulletin*, 1937, Vol. 34, p. 40). The work described was carried out in two areas—the Fung

district, near the border of Abyssinia and to the west of the Blue Nile, and the Kapoeta district on the Uganda-Kenya border. In both these districts the minimum rainfall is 10 inches, giving a relatively low temperature and high humidity, which appear to be the necessary conditions for the existence of the disease, which is not found in the drier areas of the Sudan. That the disease is fairly common is shown by the recognition of 289 cases in 1934 and 171 in 1935. It is seen mostly in adults and occurs in towns as well as in villages, while housing conditions and state of nourishment do not affect the incidence. It is found quite commonly in the well-housed and well-fed military and police.

Clinically the disease is not to be distinguished from kala azar of other countries. It was noted, however, that cases in the Kapoeta district showed massive infections of the spleen with the regular occurrence of parasites in the peripheral blood, while in the Fung district the infections were less intense and parasites were never found in the blood, in spite of the examination of 320 films from 35 cases.

Leishmania were found in nasal smears of 7 of 35 cases examined. The nasal material from one of these cases produced infection in two monkeys, one by intradermal inoculation, the other by nasal swabbing. As the nasal swabbing might have damaged the nasal mucosa, an attempt was made to infect another monkey by spraying with a scent spray on to the nasal mucosa a liquid containing leishmania. The monkey was found infected 99 days later. No evidence could be obtained that healthy persons in contact with kala azar cases harboured leishmania in the nasal or tonsillar mucosa.

A large number of animals, including dogs, were examined but no evidence of leishmania infection was found. Insect surveys yielded amongst blood suckers mosquitoes, bugs, lice, ticks, fleas and sandflies, the last named including *Phlebotomus papatasi* and *P. perniciosus*.

Certain interesting contact experiments with monkeys were carried out. In one, four healthy monkeys were kept together in an insect-proof room with four older monkeys inoculated intraperitoneally with kala azar material. The four inoculated animals acquired kala azar, as also did two of the others which were found infected on the 85th and 87th day of the experiment. The experiment was repeated, with the result that three of the uninoculated monkeys were found infected 104, 104 and 113 days later. No opinion is expressed as to how infection occurred. As a prophylactic measure it is suggested that intensive inspection of the population in May and June each year, with a view to the detection and treatment of as many cases as possible, would reduce the number of cases carrying over from one year to another and so lower the incidence in the following season. This is based on the assumption that the new infections occur in the period July to October, when there exists the necessary humidity, the rest of the year being dry and arid as in the northern parts of the Sudan where kala azar does not occur.

No definite statement regarding the method of transmission is made. It is concluded that the problem of transmission of kala azar in the Sudan, as in other countries, still awaits solution. Nevertheless, it seems that the authors incline to the view that direct case-to-case infection occurs. Various speakers in the discussion which followed the presentation of the paper argued in favour of sandfly transmission, which it was maintained had been almost if not completely established in other countries. *C. M. W.*

DA CUNHA (A. Marques) & CHAGAS (E.). Etudes sur la leishmaniose viscérale du Brésil. Vérification du parasite par ponction de la rate et du foie ; culture et aspect morphologique ; considérations d'ordre général. [**Visceral Leishmaniasis in Brazil. Parasites found by Spleen Puncture ; Culture, Morphology, General Considerations.**]—*C. R. Soc. Biol.* 1936. Vol. 123. No. 31. pp. 709-711. With 3 figs.

CHAGAS (E.). Leishmaniose visceral americana. (Nova entidade morbida do homem na America do Sul.) [**Visceral Leishmaniasis a New Morbid Entity of Man in South America.**]—*Hospital.* Rio de Janeiro. 1937. Feb. Vol. 11. No. 2. pp. 145–147. English summary (2 lines).

DA CUNHA (A. Marques) & CHAGAS (E.). Nova especie de protozoario do genero leishmania pathogenico para o homem. Leishmania Chagasi, n. sp. [**New Species of *Leishmania* Pathogenic for Man.**] —*Ibid.* pp. 148–152.

CHAGAS (E.) & CASTRO (Gustavo de Oliveira). Nova systematisção das leishmanioses. [**New Classification of the Leishmaniases.**]—*Ibid.* p. 153. English summary (2 lines).

These four papers relate to the occurrence of kala azar in Brazil. The examination for evidence of yellow fever of pieces of liver taken by viscerotomy post-mortem from a large number (about 70,000 up to November 30, 1935) of cases which had died of some undiagnosed fever had revealed leishmania infection in 70. This led to a search for actual cases of kala azar, the first of which was noted by the present author in 1936 (this *Bulletin*, 1936, Vol. 33, p. 500). In the four papers now under review four cases are mentioned, in three of which parasites were found by spleen puncture. From one of the cases brought into hospital at the Oswaldo Cruz Institute cultures of the parasite were obtained, its morphology studied and animal experiments instituted. The parasite apparently resembles *Leishmania donovani* and the disease kala azar, nevertheless, because of certain differences obtained with various sera in agglutination and absorption tests which, however, are notoriously unreliable with leishmania, it is concluded that a distinct species of *Leishmania*, *L. chagasi*, is involved. Furthermore the arrangement of the three species, or supposed species, of *Leishmania* of the Old World and the diseases they produce in one group and *L. brasiliensis* and the new one of the New World in another group is considered to be a new classification of the leishmaniases. *C. M. W.*

SAITO (Yasuichi). **Investigations of the Biological Character of *Leishmania donovani*. II. Report. Resistance of *Leishmania donovani* to Chemical and Physical Environment.**—*Jl. Oriental Med.* 1936. Oct. Vol. 25. No. 4. [In Japanese pp. 885–905. [17 refs.] English summary pp. 73–74.]

The paper records the results of experiments to test the degree of resistance of the cultural forms (designated " worms " in the paper) to heat and cold, disinfectants, radium emanations and X-rays, saponin, alkaloids, and sera. The results are given in catalogue form. *C. M. W.*

SAITO (Yasuichi). **Investigations of the Biological Character of *Leishmania donovani*. III. Report. Investigations on the Necessity for the Growth of *Leishmania donovani* in vitro.**—*Jl. Oriental Med.* 1937. Jan. Vol. 26. No. 1. [In Japanese pp. 111–138. [36 refs.] English summary pp. 9–10.]

By varying the culture conditions both in and outside the medium the author has arrived at certain conclusions as to the factors which are most favourable to growth. These are given in a catalogue in the paper. *C. M. W.*

SANGIORGI (Giuseppe). Vielgestaltigkeit des Virus Donovani. [**Polymorphism in** *L. donovani*.]—*Muench. Med. Woch.* 1937. Mar. 5. Vol. 84. No. 10. pp. 365–366.

In preparations made from the spleen of a case of kala azar the author was much struck by the great variation in size, shape and structure of the leishmania which were present. This appearance, unusual in his experience, leads him to wonder if within the single species *Leishmania donovani* there may not be variants which are responsible for the differences which have been noted in the disease in different districts.

C. M. W.

KHODUKIN (N. J.), SOFIEFF (M. S.) & KEVORKOFF (N. P.). Sur l'identification des différentes souches de leishmanies. (Problème de l'agent pathogène des leishmanioses.) [**Identification of the Different Strains of Leishmania.**]—*Ann. Inst. Pasteur.* 1936. Nov. Vol. 57. No. 5. pp. 487–515.

This appears to be a French version of a Russian paper already noticed in this *Bulletin*, 1936, Vol. 33, p. 506. *C. M. W.*

CARONIA (G.). E il flebotomo l'agente trasmissore della leishmaniosi? [**Is the Sandfly the Vector of Leishmaniasis ?**]—*Riv. di Parassit.* Rome. 1937. Jan. Vol. 1. No. 1. pp. 19–29. English summary (8 lines).

In this paper the author reviews the literature dealing with the method of transmission of kala azar, particularly that describing experiments with sandflies and the attempts at direct infection by way of the mouth. The author, who has had a long experience of kala azar in Italy and Sicily, concludes that though the theory of sandfly transmission seems an attractive one it is not possible to assert that the last word has been said on this controversial subject.

C. M. W.

SMITH (R. O. A.), MUKERJEE (S.) & CHIRANJI LAL. **Bionomics of *P. argentipes*. Part II. The Breeding Sites of *P. argentipes* and an Attempt to control these Insects by Anti-larval Measures.**—*Indian Jl. Med. Res.* 1936. Oct. Vol. 24. No. 2. pp. 557–562.

The observations recorded in this paper were carried out in a village a few miles south of Calcutta in which the incidence of kala azar in the last epidemic had been high. During two years, systematic search was made for adult *Phlebotomus argentipes* in houses and cattle

sheds: they were more plentiful in the latter. Search was also made for breeding places. Practically every sample of soil in which larvae were found was obtained within twenty yards of a house or cattle shed. Spraying breeding sites and the surrounding area with necrosene and with a crude oil and kerosene mixture were tried; this proceeding appeared to have no influence on the numbers of *P. argentipes* found in house or cattle shed. The authors conclude that this species would be more easily controlled, in rural areas, by measures directed against the adult insect, by means of sprays or fumigation, than by anti-larval measures. *Norman White.*

Bonan (Hector) & Mamou. Sur une forme atypique du kala-azar de l'adulte l'hépatite leishmanienne ictero-ascitique. [**Ictero-ascitic Leishmanial Hepatitis in the Adult.**]—*Tunisie Méd.* 1937. Jan. Vol. 31. No. 1. pp. 17–21.

A man 39 years of age became progressively ill with wasting, anaemia and subacute fever combined with enlargement of the spleen and especially the liver. Later there was jaundice, epistaxis, purpura and ascites. The diagnosis was obscure. Malaria was excluded by failure of response to quinine and absence of parasites. Amoebic abscess was suspected but emetin failed to influence the condition. The man's vocation, that of a wine dealer, led to suspicions of alcoholic cirrhosis but no evidence of alcoholic excess could be obtained. Finally a diagnosis of kala azar was suggested. Various serological tests gave indications of the correctness of this diagnosis, which was confirmed, in the authors' opinion, by the rapid response to antimony treatment. The patient had refused spleen puncture. The conclusion is reached that this case illustrates a new clinical type of kala azar in which the main symptoms are attributable to derangement of the liver. *C. M. W.*

d'Oelsnitz, Vian (L.) & Barbe (R.). Gros ventre, aménorrhée et masque pigmentaire chez une jeune femme atteinte de kala-azar autochtone. [**Enlarged Abdomen, Amenorrhoea and Pigmentation of the Face in Kala Azar.**]—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1937. Jan. 25. 52nd Year. 3rd Ser. No. 2. pp. 38–41.

This is a long account of an uncomplicated case of kala azar in a young woman in the south of France. Emphasis is laid on the fact that the progressive enlargement of the abdomen, the amenorrhoea and the pigmentation had led the woman to submit to obstetrical examination. It was after the exclusion of any obstetrical cause for her condition that a general medical examination followed by sternal puncture led to a correct diagnosis. A complete cure was effected with neostibosan. A special note is made of the enlargement of the epitrochlear glands, which the authors have previously described as a special feature in cases of this disease. *C. M. W.*

Chorine (V.). Les réactions sérologiques dues aux euglobulines. [**Serological Reactions due to the Euglobulins.**]—*Ann. Inst. Pasteur.* 1937. Jan. Vol. 58. No. 1. pp. 78–124. With 2 figs. [102 refs.]
[**Kala Azar** pp. 107–117.]

The author discusses the various serological reactions which depend on the presence in the serum of increased quantities of euglobulin.

As regards the reaction of Henry, advocated for the diagnosis of malarial infection, he is in agreement with WISEMAN (this *Bulletin*, 1935, Vol. 32, p. 130) that the flocculation brought about by the addition to serum of solutions of melanin is due to the distilled water and not to the presence of some anti-melanin substances which have been generated in the body as a response to the continued liberation from malarial parasites of malarial pigment. The presence of melanin in solution merely renders the flocculi more apparent. A very fine suspension of carmine gives even better and clearer results. The reaction is dependent upon an increase in euglobulin and a diminution of the albumin as well as on the presence of fats and free cholesterin, which are insoluble in distilled water. Another similar reaction is that of Vernes in which the reagent is resorcin, which likewise gives a precipitate in serum of tuberculous patients in the presence of excess of globulins. In this case, however, it is a reaction of coagulation and not merely a question of insolubility in distilled water. This action of resorcin is shared by phenols in general, which coagulate both euglobulin and pseudoglobulin, though the former is more concerned in the reaction than the latter. It seems that the euglobulin differs from that in malaria and that they are both distinct from that of normal serum.

It is in kala azar that the euglobulins are most markedly increased, while the albumin is reduced in amount, and this is responsible for the number of reactions which have been devised as tests for the disease. This euglobulin in kala azar serum does not appear to be the same as the euglobulin in normal serum, from which it can be separated by precipitation with 0·4 per cent. sodium chloride solution.

As regards the formol gel reaction it is found that the development of opacity is a different phenomenon from gelification. Thus by fractional precipitation with 2 to 4 per cent. sodium chloride solutions and dialysis against distilled water three grades of euglobulin are obtained. The most insoluble added to normal serum causes gelification with opacity to occur in under an hour in the formol gel test, whereas the addition of either of the other more soluble grades causes gelification to take place without opacity. It seems that the insoluble grade is that one found in kala azar but in any case, for the reactions to succeed, it is necessary for the total euglobulins to be in excess. With this quantity of euglobulin in kala azar serum it is to be expected that flocculation would occur with distilled water, as in Brahmachari's distilled water test. The phenols, of which resorcin is one, also gave precipitation, as they do in Vernes' tuberculosis test. Phloroglucin acts like phenol, as does tannin. It seems that the tests in which organic antimony compounds are used, such as the urea stibamine test of Chopra and the similar one of Nattan-Larrier, depend not on the antimony present but on simple alcohol or phenol groups. It may be noted that the addition of 1 cc. of ethyl alcohol to 1 cc. of diluted kala azar serum (1/10 in physiological saline solution) at a temperature of 30°C. gives a marked turbidity, while normal serum similarly tested remains clear. In another direction flocculation by distilled water may be increased by reduction of pH, which in the reaction of Auricchio and Chieffi is brought about by the addition of peptonate of iron to the distilled water. The author has done a useful service in attempting to explain the various serological tests based on euglobulin increase and in giving his readers a rational account of what was

tending to become a somewhat confusing subject. It is clear that those who are interested in these serological reactions will have to read this paper in its entirety. *C. M. W.*

Krishnan (K. V.), Pai (N. G.) & Bose (P. N.). **Changes in Certain Chemical Constituents of the Blood in Kala-Azar.**—*Indian Med. Gaz.* 1936. Oct. Vol. 71. No. 10. pp. 574–576. [12 refs.]

A number of cases of kala azar in the Carmichael Hospital for Tropical Diseases, Calcutta, were investigated from the point of view of changes in the cholesterol, glucose and phosphorus content of the blood. Of these, cholesterol alone showed any abnormality, being low in advanced cases. A return to the normal level occurred with treatment and cure. *C. M. W.*

Kopaczewski (W.). Gélification des constituants sanguins. [**Gelification of Blood Constituents.**]—*C. R. Acad. Sci.* 1937. Feb. 8. Vol. 204. No. 6. pp. 453–456.

The authors have investigated the part played in gelification by the various blood constituents, plasma, serum, red blood corpuscles, which for purposes of the investigation have been separated from one another. All the three constituents mentioned will give gelification with suitable reagents but the most rapid is obtained with the laked red blood corpuscles. It is noteworthy that a concentration of red blood corpuscles similar to that of the normal blood is gelified by lactic acid in a strength only a little above that which occurs in normal blood. The laking of the red blood corpuscles if not brought about by their suspension in distilled water results immediately on the addition of the gelifying reagent. *C. M. W.*

Martillotti (F.). La ricerca del parassita di Leishmann per mezzo di strisci dermici. [**Examination of Dermal Smears for Leishmania.**]—*Pediatria.* 1937. Mar. 1. Vol. 45. No. 3. pp. 213–215.

The author has investigated the possibilities of diagnosing infantile kala azar by the examination of smears made from the dermis but has reached the conclusion that this method, owing to the difficulty of interpreting the structures seen, cannot replace the search for parasites in spleen or bone marrow. *C. M. W.*

Malamos (B.). Diagnostische Intrakutanreaktionen bei den Leishmaniosen. [**Diagnostic Skin Test for Leishmaniasis.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1937. Feb. Vol. 41. No. 2. pp. 240–243.

In an earlier paper on leishmaniasis in Canea (this *Bulletin*, 1937, Vol. 34, p. 40) certain experiments on skin reactions following intracutaneous injection of leishmania antigen in cases of kala azar and oriental sore were described. In the present paper a more detailed description of these is given and the results are discussed from the point of view of the possibility of a skin test as a diagnostic procedure. As previously noted, the reaction is a group one, but a *Leishmania donovani* antigen will give a positive reaction in cases of kala azar more frequently

than in cases of oriental sore and *vice versa*, provided the infections in both cases have been of sufficient standing. Early cases fail to give a reaction. *C. M. W.*

GIRAUD (Paul), MONTUS, SARDOU & GAUBERT. Le diagnostic du kala-azar par la ponction ganglionnaire. [**Gland Puncture for Diagnosis of Kala Azar.**]—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1936. Nov. 23. 52nd Year. 3rd Ser. No. 31. pp. 1493–1496.

The authors call attention to the practicability of gland puncture for the diagnosis of kala azar. Two cases in children are described in which this procedure was easily carried out on inguinal glands. COCHRAN (1912), writing of kala azar in China, suggested excision of glands for the diagnosis of the disease. *C. M. W.*

LORANDO (N.). La ponction sternale, méthode de choix pour la recherche des leishmanies. [**Sternal Puncture Best Method for Diagnosis of Kala Azar.**]—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1937. Mar. 8. 53rd Year. 3rd Ser. No. 8. pp. 314–316.

In the author's experience the operation of sternal puncture for the diagnosis of kala azar is a simpler procedure than spleen puncture. During the course of 1936 sternal puncture was performed by him in six cases in Athens, in all of which leishmania were found by examination of the bone marrow smears. *C. M. W.*

GIRAUD (Paul) & GAUBERT. Valeur de la ponction de la moelle osseuse pour le diagnostic du kala-azar méditerranéen (d'après les résultats de 22 ponctions du tibia). [**Puncture of the Tibia for Diagnosis of Kala Azar.**]—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1937. Mar. 15. 53rd Year. 3rd Ser. No. 9. pp. 336–339.

The authors find that puncture of the tibia in young children is a simple operation which can be carried out without any local anaesthetic. The point chosen is the outer face of the tibial epiphysis 1 cm. below the knee joint. A fine trochar and canula is passed in till entry into the spongy tissue is felt by the sudden loss of resistance. The trochar is removed and the canula is moved about to encourage entry into it of bone marrow. The canula is then closed with the finger and withdrawn, and films made from the contents. The procedure, though perhaps not so reliable for diagnostic purposes as spleen puncture, is so simple that it should always be tried before the more serious spleen puncture is attempted. *C. M. W.*

FAN (P. L.). **Use of a Pentavalent Antimony Compound for treating Kala-Azar in Children.**—*Amer. Jl. Dis. Children.* 1936. Oct. Vol. 52. No. 4. pp. 887–891. With 1 chart.

The paper describes the successful treatment of kala azar in a boy by neostibosan in N. China at the Cheeloo University children's clinic. Mention is made of 235 other patients who were treated with the same remedy and discharged from hospital. Replies to enquiries

were received from 127 of these one month to seven years following completion of treatment and from these it appeared that 96·9 per cent. had been cured. *C. M. W.*

Vlach (Giuseppe). La leishmaniosi canina in Trieste e Provincia. [**Canine Leishmaniasis in the Trieste Region.**]—*Arch. Ital. Sci. Med. Colon. e Parassit.* 1936. Sept. Vol. 17. No. 9. pp. 513–541.

The examination of spleen smears from 115 dogs in Trieste or the surrounding district for evidence of leishmania infection has given an infection rate of about 1·8 per cent. *C. M. W.*

Nicolau (S.) & Pérard (Ch.). Etude histo-physio-pathologique de l'oeil et du système nerveux dans la leishmaniose généralisée du chien. [**Histo-Physio-Pathological Study of the Eye and Nervous System in Generalized Canine Leishmania.**]—*Ann. Inst. Pasteur.* 1936. Nov. Vol. 57. No. 5. pp. 463–486. With 19 figs. [46 refs.]

The authors have made a detailed study of the eye and nervous system in cases of canine kala azar. Examination of eyes which have appeared quite normal has shown that leishmania infected macrophages occur in all parts of the eye except the lens and the retina. The presence of parasites in healthy eyes is compared with their occurrence in apparently normal skin, as has been described by a number of observers. In the nervous system generally infected cells have been found in the choroid plexus, which appears to prevent the passage of parasites into the substance of the brain. Sometimes parasitized cells were seen in the meninges. Like the brain, the substance of the spinal cord was free, though infected cells were seen in the nerve roots, posterior ganglia and in the peripheral nerves like the sciatic nerve. It is concluded that the presence of cells in the nervous tissues accounts for the various nervous symptoms which sometimes characterize cases of kala azar. The paper is well illustrated by drawings depicting the various findings. *C. M. W.*

Donatien (A.) & Lestoquard (F.). Le parasitisme du poumon dans la leishmaniose générale du chien. [**Parasitism of the Lung in Generalized Leishmaniasis of the Dog.**]—*Bull. Soc. Path. Exot.* 1937. Jan. 13. Vol. 30. No. 1. pp. 28–31.

The authors find from the post-mortem examination of ten dogs suffering from canine kala azar that leishmania infection of the lungs is of regular occurrence in this disease. The degree of infection, as judged by the number of parasites in smears, is very variable. These findings are compared with the frequent presence of *Rickettsia canis* in monocytes of the lung in infected animals. *C. M. W.*

Giraud (P.) & Cabassu (H.). Le diagnostic de la leishmaniose canine par la ponction ganglionnaire. [**Gland Puncture for Diagnosis of Canine Kala Azar.**]—*Bull. Soc. Path. Exot.* 1936. Nov. 18. Vol. 29. No. 9. pp. 958–962.

The authors advocate puncture of the lymphatic gland for the diagnosis of canine kala azar. When there are well developed skin

lesions the regional glands are much enlarged and the operation of puncture is simple. Though in other cases it is more difficult, it can nevertheless be carried out successfully. *C. M. W.*

NAPIER (L. Everard) & HALDER (K. C.). **The Incubation Period of Oriental Sore.**—*Indian Med. Gaz.* 1936. Dec. Vol. 71. No. 12. pp. 723–724. With 1 fig.

The author records a case of oriental sore in a man in Calcutta in which the first signs appeared on the bridge of the nose more than three years after the man left his home in Rajputana, an epidemic area for the disease. *C. M. W.*

GOODALL (J.). **Clinical Study of Sixty-Three Cases of Oriental Sore.**—*Indian Med. Gaz.* 1937. Jan. Vol. 72. No. 1. pp. 3–9. With 14 figs. (10 on 2 plates).

After the earthquake in Quetta on May 30, 1935, two companies of K.G.O. (Bengal) Sappers and Miners were sent to carry out relief work. Most of the men, about 550 in number, set out from Roorkee on June 1 and returned in November. During the stay in Quetta or after return to Roorkee approximately 11·8 per cent. developed oriental sore. The number of sores per man varied from 1 to 17, the commonest number being 3 to 8. Potassium antimony tartrate 1·5 grain administered intravenously twice a week was the average treatment, while locally the sores were covered with a simple saline dressing; sometimes local injections of emetin or orisol (berberine) were given. In one case neostibosan was administered. There was considerable variation in the time taken for the cases to heal. Some cleared up after the administration of two or three grains of tartar emetic combined with local treatment, others required more than eighteen grains. In chronic cases, the most difficult to cure, the local use of emetin hastened recovery as also did the local dressings if not neglected. Some cases in which the local dressings were kept clean had recovered in three to six weeks, while others in which the sores were allowed to become septic lasted as long as four months.

The editor (NAPIER) adds to the paper certain comments. It was possible to determine a longer incubation period than three months in 56 per cent. of the cases and one longer than four months in 19 per cent. Though it is known that the incubation period is frequently more than four months there has been a tendency to favour a period shorter than three months. The cases in this series do not favour a shorter period. Charts of the distribution of the sores show that they had the same distribution as in those prepared by ACTON (1919) and that they correspond with the sites chosen by sandflies for biting. Certain sores in which leishmania were not discovered had the same distribution and were thus undoubtedly oriental sores with scanty parasites. In cases with multiple sores these occupied the same sites as those with single or few sores, a fact which suggests that the multiple sores have the same aetiology as the single sore and do not result from spread of parasites by the blood or lymphatics. The cases appear to demonstrate that tartar emetic is the mainstay in treatment of this disease, a result of some importance in view of the low cost of this drug. *C. M. W.*

Trow (Emerson J.). **Oriental Sore. Report of a Case.**—*Arch. Dermat. & Syph.* 1937. Mar. Vol. 35. No. 3. pp. 455–458. With 3 figs.

A record of a typical case of oriental sore with lesions on the nose and arm in a patient who had returned to Canada from India by way of Mesopotamia. *C. M. W.*

Dostrovsky (A.). **Relapses in Cutaneous Leishmaniasis.**—*Ann. Trop. Med. & Parasit.* 1936. Oct. 21. Vol. 30. No. 3. pp. 267–274. With 5 figs. on 1 plate.

Writing of cutaneous leishmaniasis in Palestine the author notes that usually there is a single lesion but that sometimes more than one occurs. The single lesion may heal entirely but occasionally nodules appear round the primary lesion or even round its scar after complete healing. As these nodules heal others may appear outside them. The regional lymphatic gland may become involved and nodules may develop along the course of the lymphatics connecting the region of the sore to the gland. Cases of the type described and illustrated in this paper are very chronic and may give histories of six years. In the chronic lesions it may be difficult to find leishmania. *C. M. W.*

Berny (P.). Floculation du sérum dans l'eau distillée et leishmaniose cutanée américaine. [**Flocculation of Serum in Distilled Water with Relation to American Cutaneous Leishmaniasis.**]—*Bull. Soc. Path. Exot.* 1937. Feb. 10. Vol. 30. No. 2. pp. 134–135.

In an earlier paper (this *Bulletin*, 1935, Vol. 32, p. 130) Chorine, Prudhomme & Koechlin have described the flocculation which occurs when serum from patients suffering from various diseases is diluted ten-fold with distilled water. The degree of flocculation varies. Normal as well as syphilitic sera flocculate hardly at all; malarial serum flocculates well, while kala azar serum does so abundantly. By a photometric method the degree of flocculation can be given a numerical value. When this is in the region of 100 kala azar can be suspected.

In the present paper is given an account of tests carried out in ten cases of South American cutaneous leishmaniasis. Most of the sera gave very weak flocculation, the figures varying from 2 to 37. In two cases, however, figures of 80 and 105 were obtained. The precautionary remark is made that from time to time sera are encountered which give an abundant flocculation without there being any evidence of leishmania infection. *C. M. W.*

Savon Salaberry (Julio). Leishmaniosis tegumentaria y mucosa americana. (Estudio de algunos casos. Tratamiento.) [**Treatment of Cutaneous and Mucosal Leishmaniasis.**]—*Prensa Méd. Argentina.* 1936. Oct. 21. Vol. 23. No. 43. pp. 2427–2436. With 20 figs.

In this illustrated article the author calls attention to the frequence of cutaneous and mucosal leishmaniasis in the northern parts of the Argentine. Treatment by various preparations of antimony has given good results but the best have been obtained with fouadin, which has been used both intramuscularly and intravenously. *C. M. W.*

Flye Sainte Marie (P.). Un nouveau cas de bouton d'orient observé dans le Nord Marocain. Traitement par l'antimoniothiomalate de lithium (anthiomaline) en injections locales ; guérison rapide. [**A Case of Oriental Sore in N. Morocco. Rapid Cure by Local Injections of Anthiomaline.**]—*Bull. Soc. Path. Exot.* 1936. Oct. 14. Vol. 29. No. 8. pp. 881–885. With 3 figs. [17 refs.]

The case concerned a child, 12 years of age, with a large fungating oriental sore of about a year's standing on the left cheek. A cure was obtained in the remarkably short time of two weeks by a series of local injections of the preparation referred to in the title, the contents of a 1 cc. ampoule being diluted with 5 cc. of distilled water. The sore was covered with a dressing charged with 12 cgm. of the compound.

C. M. W.

Lawrow (A. P.) & Dubowskoj (P. A.). Ueber Schutzimpfungen gegen Hautleishmaniose. [**Inoculation against Oriental Sore.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1937. Apr. Vol. 41. No. 4. pp. 374–379.

In localities where oriental sore is common the only method of protection is the prevention of the disease in undesired positions on the body by direct inoculation at a chosen site. In some cases it is possible to inoculate from one person to another on the arm or leg but this cannot be done on a large scale. The authors, working in S.E. Russia, have been experimenting with cultures of leishmania which it is possible to maintain without difficulty in the clinics. During the past few years about 500 persons have been inoculated intracutaneously with 0·1 to 0·2 cc. of culture. In 73 per cent. of the cases a sore developed at the site of inoculation after an incubation period of 2–6 months. The lesion increased in size for 2 or 3 months and then gradually healed in 6 to 12 months. The immunity which has then been acquired will prevent any further infection and the scars on exposed parts of the body, which in some cases are very disfiguring.

C. M. W.

MALARIA.

Wilson (D. Bagster) & Wilson (Margaret E.). **The Manifestations and Measurement of Immunity to Malaria in Different Races.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1937. Jan. 26. Vol. 30. No. 4. pp. 431–448. With 5 figs. [25 refs.]

This discussion, based on the findings of the authors and other workers, of spleen and parasite rates in Indians, Malays, Bantu and Masai, is chiefly concerned with the light such data throw on the question of immunity. The authors were at pains to ascertain whether differences in such endemic data represent racial distinctions in the human reaction to malaria. They conclude that such differences may be explained in terms of immunity and hypersensitivity and that the immune status is not dependent upon race but upon frequency of infection. Frequency of infection in the non-immune, that is in early life, is the most accurate index of endemicity. Variation with age in the spleen and parasite rates is of greater significance than the spleen rate and the endemic index in assessing endemicity and immunity and its study may enable a rough classification of communities into immune and sub-immune. The suggestion is made that the average parasite count, and its variation with age, are the most sensitive index available for field studies. *Norman White.*

Meleney (Henry E.). **The Problem of Malaria Mortality in the United States.**—*Amer. Jl. Trop. Med.* 1937. Jan. Vol. 17. No. 1. pp. 15–24.

This presidential address to the American Society of Tropical Medicine directs attention to the continued importance of malaria as a cause of mortality in thirteen southern States. In 1934 there were 3,900 deaths ascribed to malaria in these States, a figure but little short of that of the mortality from typhoid fever and diphtheria combined. The author considers that a significant reduction in this malaria mortality might be, and should be, effected. To this end he urges the creation in all States of a rapid diagnostic service for malaria; the instruction of all physicians more especially with regard to the value and limitations of the newer synthetic drugs and the necessity of intravenous medication for critically ill patients; popular education stressing, among other things, the inadequacy of self-treatment; and a limitation of the sales of chill tonics. The recommendation is also made that State Health Departments should investigate all deaths ascribed to malaria as well as deaths from acute diseases in which the diagnosis is doubtful. Finally, attention is drawn to the importance of all medical schools providing adequate instruction in the clinical and laboratory diagnosis of malaria and its treatment. *N. W.*

Worth (H. N.). **The Control of Anopheline Breeding in River Beds.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1937. Mar. 4. Vol. 30. No. 5. pp. 521–530. With 12 figs. on 4 plates.

In Ceylon *A. culicifacies*, the chief if not the only vector of malaria, frequently breeds in the pools and shallows of river beds, particularly in the wide sand-bottomed rivers. This interesting paper describes an engineer's attempts at eliminating such breeding, by the control of

low water channels. The work was carried out in the Badulla Oya River, which is about 150 feet wide ; most of it has a sandy bed but in the upper reaches boulder and rock formations occur. The rocky section was treated by draining, filling and sealing. For the sandy portion use was made of a dry-weather channel control method that has been long used in Burma to facilitate the rafting of logs from the teak forests, modified to suit local conditions. The method comprises the construction of low parallel bamboo stake fences along both sides of the dry weather channel. These are designed to cause the deposition of suspended silt, thus causing an increase in the height of the side banks. Spur dykes, of similar construction, were placed at intervals of 50 to 75 feet between the banks and the channel fence. As the fall of the river bed is considerable, up to 1 in 600, a number of check dams were constructed across the river from bank to bank to prevent scouring of the channel itself. These check dams were formed of three rows of bamboo stakes, four feet apart, and the enclosures between were packed with loose boulders. The results of the experiments have shown that pools and shallows in river beds, which formed the main breeding places of *A. culicifacies* during the recent epidemic, can be enormously reduced and, in certain situations, entirely eradicated by the adoption of suitable engineering devices. As a preliminary measure it is important to remove all temporary obstructions to the flow of the river, such as trees, logs and débris. The photographs illustrating this paper are excellent. *N. W.*

Pampana (E. J.). Malaria in Italy and " Bonifications."—*Malayan Med. Jl.* 1937. Mar. Vol. 12. No. 1. pp. 1–8. With 2 charts.

Strickland (C.). **Papers on Malaria in Malaya.**—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1936. Vol. 25. No. 3. pp. 331–340. With 4 plates.

The observations recorded in this paper were made when the author was Malariologist to the Government of the F.M.S. They were made some twenty years ago. An interesting account is given of the mangrove forests of Malaya, their formation, flora and fauna. No anophelines were discovered in the different mangrove zones of the coast, nor was there evidence of malaria incidence among people living in close relation to mangrove. Mangrove from the point of view of malaria is, therefore, harmless. *N. W.*

Ejercito (A.). Mendiola (J. C.) & Baisas (F. E.). **Can Malaria be contracted in Manila ?**—*Rev. Filip. Med. Farm.* Manila. 1936. June. Vol. 27. No. 6. pp. 243–262. With 1 fig. [Summarized in *Rev. Applied Entom.* Ser. B. 1937. Feb. Vol. 25. Pt. 2. pp. 29–30]

" In an attempt to establish whether malaria can be contracted in Manila, the authors made investigations in 1933–35 on reported cases, the prevalence of malaria in the area of the city most concerned, and its Anopheline population. Of 81 cases confirmed from 1st March 1933 to 31st October 1935, all had probably contracted the disease in the provinces. They included 3 cases, however, that appeared to incriminate the Santa Ana district of Manila, and a survey of the inhabitants of 80 per cent. of the houses in it was therefore made.

Of 62 children under the age of ten, two showed splenomegaly and none a positive blood test, while of 192 persons over ten, one showed a positive blood test and none splenomegaly. Similar tests in the local elementary school, in which 214 persons were examined, gave negative results.

" Observations made from 18th August to 15th November 1935 on Anophelines in this district of Manila, a circle with a radius of nearly a mile, showed that at first very little breeding took place, owing to floods and heavy rains, but gradually more breeding was observed, the amount falling again at the end of October, owing to the drying up of pools, etc. Of 631 Anopheline larvae collected and identified, 346 (55 per cent.) were *Anopheles hyrcanus* var. *nigerrimus*, Giles, and 227 (36 per cent.) *A. vagus* var. *limosus*, King. The others were *A. annularis*, Wulp (11), *A. barbirostris*, Wulp (2), *A. hyrcanus* var. *sinensis*, Wied. (13), *A. philippinensis*, Ludl. (22), *A. subpictus* var. *indefinitus*, Ludl. (9), and *A. tessellatus*, Theo. (1). Dissections were made of 983 adult females belonging to all these species, 189 of these being *A. hyrcanus* var. *nigerrimus*, 191 *A. subpictus* var. *indefinitus*, and 512 *A. vagus* var. *limosus*, and the results are tabulated. None was infected. No examples of *A. maculatus*, Theo., or *A. minimus* var. *flavirostris*, Ludl., the vectors of malaria in the Philippines, were found, although suitable breeding places exist, no Anophelines were caught inside houses and very few outside in their vicinity, and most of them were caught near buffalos, cows and pigs.

" In accordance with this evidence, it is concluded that malaria is not contracted in Manila."

Wong (Helena), Kang (T.) & Jarvis (B. W.). **Some Notes on Malaria in Foochow. A Review of 107 Cases in 1935.**—*Chinese Med. Jl.* 1937. Mar. Vol. 51. No. 3. pp. 385–390. With 1 fig. [10 refs.]

Malaria has increased in Foochow during recent years : the increase is attributed to the influx of refugees from north-west Fukien and to the return of soldiers from Central China. A clinical description is given of 107 cases treated as inpatients in hospital. Fifty-nine of these were subtertian infections. The disease was most prevalent in November. Rainfall is plentiful from April to August, being most plentiful in June.

N. W.

Drbohlav (J.). Sur l'épidémiologie du paludisme dans la Russie Subcarpathique de 1923 à 1936. [**Epidemiology of Malaria in Subcarpathian Russia from 1923 to 1936.**]—*Travaux Inst. d'Hyg. Pub. Etat. Tchécoslov.* 1936. Vol. 7. No. 4. pp. 158–172. With 24 figs. on 14 plates.

Subcarpathian Russia is the easternmost of the four administrative divisions of Czechoslovakia. It lies to the south of the Carpathian chain of mountains between 22°15′ and 24°34′ E. Poland borders it on the north, Hungary and Rumania on the south. The north and north-east parts of the territory are covered with forest.

For a long time past malaria has been known to exist in Subcarpathian Russia but cases were few and mild. In 1927 and 1928, however, there was a considerable extension of the disease from the south-west corner of the territory to the central and north-west parts. In 1928

some 850 cases were notified. During the following years the conditions improved but in 1933 and 1934 a still higher rise in the morbidity curve was noted : in the latter year nearly 4,000 cases were notified. The disease remains abnormally prevalent. Nearly all cases were formerly believed to be *vivax* infections : in 1936 a certain number of *falciparum* infections were observed.

Gipsy hamlets with their primitive insanitary conditions play a rôle of importance in spreading infection. Their houses are built of sun-dried bricks, the clay for this purpose being excavated close to the site of the dwelling. The borrow-pits thus formed are important breeding places for anophelines. *A. maculipennis* is the predominant species. *A. elutus* and *A. bifurcatus* also occur. *N. W.*

DE VERTEUIL (Eric J.) & SPENCE (T.). **Malaria in Trinidad. Low Tide Level Culvert System in Coastal Drainage.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1937. Jan. 26. Vol. 30. No. 4. pp. 449–460. With 1 text fig. & 7 figs. on 2 plates.

Long before there was any precise knowledge of the factors responsible for the prevalence of malaria in Trinidad the disease diminished in intensity. The social and industrial development of the larger towns on the coast was accompanied by a decrease in the extent of brackish swamps in their vicinity. Intensive agricultural activity, cocoa and sugar-cane, added much to the prosperity of the island. Between 1910 and 1930 much valuable drainage work was done near populated areas. Extended use of quinine, improved housing and living conditions, much improved nutrition, the example given by the oil industry in the southern portion of the island in screening houses and in other matters pertaining to the welfare of the workers, all contributed to the diminished prevalence of malaria.

In 1930 a malaria survey of the island was carried out. The only two vectors of importance are *A. tarsimaculatus* and *A. cruzi* (*bellator*). The latter species breeds in collections of water at the base of leaves of bromeliads, parasitic plants which grow on trunk and branches of forest trees. When confined to the forest the species did but little harm. Unfortunately "immortelle" trees, which have been extensively planted as shade trees on cocoa estates, have become heavily parasitized by bromeliads and *A. cruzi* is now reputed to be responsible for 20 per cent. of the malaria mortality.

A. tarsimaculatus is a brackish water-breeding mosquito dependent upon the existence of coastal swamps and river mouths. This paper describes a method employed to eliminate such swamps by the construction of low-tide level culverts from the deepest part of the swamp through the sand bank. These culverts are constructed of concrete and are either open or of the box type, and provided with one or more sluice gates, according to circumstances. The reclaimed land has definite agricultural value. In many cases permanent elimination of Anopheles breeding has been obtained at small cost. *N. W.*

GERMAIN (A.) & MORVAN (A.). Paludisme à incubation prolongée. [**Prolonged Incubation Period in Malaria.**]—*Bull. Soc. Path. Exot.* 1937. Jan. 13. Vol. 30. No. 1. pp. 26–28.

The patient had done two years' service in French Indo-China during which time he was never ill. He had taken regularly 0·40 gm.

of quinine a day, increased to 1 gm. a day when on duty in the interior of the country. He left Indo-China at the end of May and went to live in a part of France where there is no indigenous malaria. On the 10th of November following he fell ill with an acute attack of malaria, *Pl. vivax*. Infection had thus remained latent for at least five and a-half months and from spring to autumn. *N. W.*

Morenas (L.) & Brun (J.). Un nouveau cas de paludisme à incubation prolongée. [**Another Case of Malaria with Prolonged Incubation Period.**]—*Bull. Soc. Path. Exot.* 1936. Nov. 18. Vol. 29. No. 9. pp. 957–958.

A man aged 23 completed his military service in Algeria in August 1935 and returned to France ; he had never been ill during his service. Nine months later, towards the end of May 1936, he fell ill with malaria. There does not appear to have been any possibility of his having acquired the infection in France. *N. W.*

Fabry (A.), Guillerm (J.) & Ragiot (Ch.). Syndrome lipoidique et parapaludisme. [**Fatty Nephrosis as a Sequel to Malaria.**]—*Bull. Soc. Path. Exot.* 1937. Jan. 13. Vol. 30. No. 1. pp. 90–98.

The syndrome, first described by Munk in 1913 under the name of fatty nephrosis, is frequently observed in Cochin-China. Ten such cases are described, all in young men. It is a chronic condition with extensive oedema. The urine is scanty and highly coloured and there is massive albuminuria. There is an increase of cholesterol in the blood, a diminution of the total serum proteins and a lowering, or even inversion, of the albuminous serine globulin ratio. Urea is normal if there is no associated nephritis. All were old chronic malaria cases. Malaria treatment was of little or no avail. The authors express the view that the condition is a paramalarial one. *N. W.*

Mallardo (C. Amatucci) & Cotrufo (P.). I mezzi di riattivazione della malaria latente. [**Reactivation of Latent Malaria.**]—*Riforma Med.* 1936. Dec. 5. Vol. 52. No. 49. pp. 1651–1655. [31 refs.]

The authors have shown that the subcutaneous injection of tuberculin (Koch's bovine tuberculin in carbolized $\frac{1}{2}$ per cent. normal salt solution) compares very favourably with the more usual methods employed to reactivate latent malaria infections, with the reappearance of gametes and schizonts in the peripheral blood. In two out of 20 successful cases a quarter of a milligram of tuberculin was sufficient ; in 16 cases half a milligram was required, in two cases one milligram. *N. W.*

Bonnin (H.) & Borneuf (R.). Les formes pseudo-peritonéales du paludisme. [**Pseudo-Peritoneal Forms of Malaria.**]—Reprinted from *Gaz. Méd. de France.* 1936. Vol. 43. No. 14. 18 pp.

This is an admirable clinical account of those forms of malaria in which abdominal symptoms give rise to suspicions of peritonitis. Such cases may present considerable difficulties in diagnosis, and are

classified by the authors as follows :—(1) Cases in which general signs of peritonitis dominate the scene. (2) Cases in which there are no precise signs of localization. (3) Cases in which pain, tenderness and rigidity are localized from the beginning, simulating, according to such localization, cases of appendicitis, gastroduodenal cases, or liver or gall bladder involvement.

The onset of such cases is generally sudden ; they occur only in places in which malaria is endemic and are generally the result of a primary infection or a recent heavy reinfection, most commonly with *Pl. falciparum*. Symptoms often suggest perforation of stomach, intestine or appendix. The pulse, however, though it may be extremely rapid, is fuller and stronger than it is in cases of general peritonitis arising from such causes. Superficial examination of the abdomen appears to cause more pain than deep palpation ; this is a characteristic sign. An examination of the blood generally reveals a heavy infection. Specific treatment is then of course indicated. It must not be forgotten, however, that an acute attack of appendicitis, for example, may complicate an attack of malaria.

This paper should be of interest to surgeon and physician alike, practising in countries where malaria is endemic. *N. W.*

Mariani (Giacomo) & Taddia (Leo). Considerazioni cliniche e morfologiche su alcuni casi di malaria osservati in Somalia. [**Atypical Cases of Malaria observed in Somaliland.**]—*Arch. Ital. Sci. Med. Colon. e Parassit.* 1936. Oct. Vol. 17. No. 10. pp. 621–627. With 15 figs.

A description of three cases of malaria with atypical symptoms observed in Somaliland. The parasites found in these three cases resemble the descriptions of *Pl. ovale*. The authors consider them to be quartan infections and ascribe the atypical morphological forms of the parasite to the influence of climate and of prophylactic quinine.

N. W.

Romanenko (A. P.). [**Two Cases of Comatose Form of Tertian Malaria treated by Subcutaneous Injections of Quinine and Methylene Blue.**]—*Med. Parasit. & Parasitic Dis.* Moscow. 1936. Vol. 5. No. 6. pp. 925–926. [In Russian.]

Description of two cases of benign tertian infection in the comatose stage treated successfully by injections of 3 and 1 cc. of 20 per cent. solution of camphor, 4 and 3 cc. of 25 per cent. solution of quinine hydrochloride, and 10 and 6 cc. of 2 per cent. solution of methylene blue. In both instances the patients gained consciousness in a few hours, and recovered completely after 4 and 5 days' courses respectively of intramuscular injections of 10 per cent. solution of quinine hydrochloride. *C. A. Hoare.*

Morenas (L.) & Brun (J.). Accès pernicieux de paludisme observé à Lyon chez un sujet ayant quitté l'Algérie depuis un mois. [**Fatal Case of Malaria.**]—*Bull. Soc. Path. Exot.* 1936. Nov. 18. Vol. 29. No. 9. pp. 953–957. With 2 figs.

A clinical and pathological description of a fatal case of cerebral malaria in a hospital in Lyons. *N. W.*

Montel (R.) & Truong van Què. Infantilisme palustre. [**Malarial Infantilism.**]—*Bull. Soc. Path. Exot.* 1936. Dec. 9. Vol. 29. No. 10. pp. 1074–1082. With 4 figs.

A short clinical description of seven cases of typical infantilism, illustrated with photographs, all of which are attributed to severe and repeated malaria infections. They were all cases of arrested development affecting growth and the sexual organs. Five were males, two females. One was aged 14; the ages of the others were between 17 and 24. Such cases, the author asserts, are amenable to appropriate anti-malaria treatment, growth and development subsequently proceeding in a normal manner, though so much delayed. *N. W.*

Shushan (Morris), Blitz (Oscar) & Adams (C. C.). **The Rôle of Reticulocytes in Malaria. Studies on Benign and Subtertian Malaria.**—*Jl. Lab. & Clin. Med.* 1937. Jan. Vol. 22. No. 4. pp. 364–370. [10 refs.]

Erythrocytes, reticulocytes and parasites were enumerated in seven cases of *vivax* and in thirteen cases of *falciparum* infection. Ninety-five preparations were examined. Excluding cases of severe anaemia, reticulocyte counts were normal or subnormal during the febrile period: irregular fluctuations in the counts were noted. Reticulocytes are selectively prone to infection by *vivax*; in *falciparum* infections reticulocytes and mature erythrocytes are equally liable to become infected. The authors consider that this may account for the higher parasite counts observed in subtertian malaria. They also consider that Schüffner's granules may be related to the basophilic stippling of reticulocytes. *N. W.*

Kotikas (Alexander). Beiträge zur Klinik und Therapie der kindlichen Malaria.—*Deut. Med. Woch.* 1936. Dec. 4. Vol. 62. No. 49. pp. 2001–2003.

Manson-Bahr (P.) & Muggleton (W. J.). *Plasmodium ovale* **Infection contracted in Different Parts of West and Central Africa.**—*Brit. Med. Jl.* 1937. Jan. 30. pp. 217–218.

A clinical description of four cases of *Plasmodium ovale* infection acquired, respectively, in Uganda, Nigeria, Belgian Congo and Sierra Leone. From the clinical point of view the cases were mild: rigors and fever recurred almost invariably during the course of the evening. Abdominal pain referred to the appendix region led to a diagnosis of appendicitis in three of the four cases. Rheumatic pain in various parts of the body, especially the lumbar region, was characteristic. *Pl. ovale* infections are very amenable to quinine or atebrin treatment. *N. W.*

Mühlens (P.). Quartana-Rückfälle nach langer Latenz. [**Relapsing Quartan Malaria Cases after Long Latency.**]—*Muench. Med. Woch.* 1937. Jan. 1. Vol. 84. No. 1. pp. 5–7. [13 refs.]

The author refers to his paper on relapse cases in war malaria [this *Bulletin*, 1937, Vol. 34, p. 369]. In the present paper he deals with four cases, including one described in a postscript, which he had met

with in the last two years. These cases had been definitely shown by microscopic investigation to be infections with *Plasmodium malariae*. Three occurred in elderly persons who had attacks of fever of the quartan type for a long period, but they were not recognized previously as malarial. Several decades before they had lived in quartan malarial areas. It was highly probable, although not capable of certain proof, that the febrile relapses occurring throughout the previous years were due to quartan infections. The fourth case was a person who had contracted quartan malaria in Macedonia during the war in 1917. He gave a history of febrile attacks with rigors in 1921, 1923 and since the beginning of October 1936. His spleen was enlarged. Specimens of his blood were sent recently to the author, who demonstrated the presence of *Plasmodium malariae* in them, so this person was suffering from a relapse due to a quartan infection contracted 19 years previously. The author stresses the importance of complete study of all attacks of fever resembling quartan malaria infections, particularly amongst persons who had served in the war.

E. D. W. Greig.

Rodríguez Molina (Rafael) & Oliver González (José). **Hematological Studies on Malaria in Puerto Rico. Report of 100 Cases.**—*Puerto Rico Jl. of Public Health & Trop. Med.* 1936. Dec. Vol. 12. No. 2. pp. 267–280. With 7 figs. [Spanish version pp. 281–294.]

A record of the results of blood examination of 83 chronic and 17 acute cases of malaria. The mean red cell count was 3·95 millions and the mean haemoglobin 85 per cent. This relatively slight degree of anaemia is attributed to racial or acquired resistance to malaria and a high protein content of the diet. A macrocytic anaemia was found in 34 cases, normocytic in 37, simple microcytic in 16 and hypochromic in 13 cases. Characteristic leukopenia was seen in 35 cases. Schilling haemograms showed a degenerative shift in the granular leucocytes. *N. W.*

Miyahara (Hatuo) & Ogura (Masatake). **Clinical Studies on Malaria. VI. Studies on Malaria-Parasite-Staining. (1). On a New and Rapid Method of staining the Parasite with Giemsa's Stain.**—*Taiwan Igakkai Zasshi* (*Jl. Med. Assoc. Formosa*). 1936. Dec. Vol. 35. No. 12 (381). [In Japanese pp. 2806–2815. With 6 figs. on 1 plate. [37 refs.] English summary p. 2816.]

The authors suggest a slight modification of staining with Giemsa solution and report good results. They make a thin film of blood and after allowing it to dry thoroughly in the air, haemolyse the corpuscles by pouring water on the slide and allow the stain, made up by adding one drop of the Giemsa to 1 cc. of sodium or potassium carbonate of a strength of 0·003–0·005 per cent. heated to 60°C., to act for 5–10 minutes. The parasites stain clearly, showing well Schüffner's dots and Maurer spots. Ziemann's dots in quartan parasites are easily recognized though they are less defined than the Schüffner. Unparasitized cells are tinted a light pink well contrasted with those containing the parasites. *H. H. S.*

HINGST (Hans E.). **Recent Observations on the Origin of Schüffner's Granules.**—*Amer. Jl. Trop. Med.* 1936. Nov. Vol. 16. No. 6. pp. 679–684.

The observations recorded in this paper were made during an attempt to confirm EATON's work on the susceptibility of red cells to malaria (see this *Bulletin*, 1935, Vol. 32, p. 423). The panoptic method of staining adopted consisted in the preliminary treatment of a clean glass slide with a saturated solution of brilliant cresyl blue in absolute alcohol. Upon this slide a thin film of blood was fixed with methyl alcohol for three minutes and then stained with Giemsa, one part in fifteen of distilled water, for thirty minutes.

Observations made on 953 parasitized red cells in 4,000 fields revealed all stages between basically stained reticular granules and eosinophilic Schüffner's granules. The author concludes that Schüffner's granules are of reticular origin. He agrees that failure to demonstrate Schüffner's granules may be due to defective staining but their presence is not constant. Specimens from two patients whose blood harboured *Pl. vivax* were examined daily for twenty days, one hundred fields of the blood film of each patient, or 4,000 fields in all. In these 4,000 fields 953 parasitized red cells were found : of these only 159 showed Schüffner's granules. In one case 36·4 per cent. of the parasitized cells showed the granules, in the other case 13·2 per cent. *N. W.*

BOYD (Mark F.), KITCHEN (S. F.) & MUENCH (Hugo). **On the Localization of the Geographical Distribution of the McCoy Strain of** *Plasmodium vivax*.—*Amer. Jl. Trop. Med.* 1936. Sept. Vol. 16. No. 5. pp. 583–587.

The authors have previously shown that patients undergoing malaria therapy exhibited varying degrees of susceptibility to the strains used according to the patients' place of origin. The McCoy strain of *P. vivax* had its origin in West Florida in 1931. Since then the strain has passed through 25 consecutive human-anopheline passages and has been used for 178 inoculations of white hospital patients. Of these 155 were successful in transferring infection. The reaction of the patient to inoculation with this strain has been further studied in relation to the place of origin of the patient. Only one patient was completely refractory to infection : he came from West Florida where the strain originated. Two other patients from Florida and one European were successfully inoculated but had no clinical attack. Nearly all other patients from the southern States were successfully inoculated and developed clinical attacks, the duration of which, however, never exceeded twenty days. Most of the patients from the northern States and from Europe had clinical attacks of thirty or more days duration. *N. W.*

BOYD (Mark F.), KITCHEN (S. F.) & MUENCH (Hugo). **Seasonal Variations in the Characteristics of Vivax Malaria.**—*Amer. Jl. Trop. Med.* 1936. Sept. Vol. 16. No. 5. pp. 589–592.

This study is based on the records of 155 patients therapeutically inoculated by Anophelines infected with *P. vivax* (McCoy strain). The observations extend over four and a-half years ; the inoculations were given in the course of twenty-five consecutive human-anopheline

passages of this strain. Inoculations during the first three months of the year result in a lower proportion of " takes " than in the remaining three quarters of the year, 56·5 per cent. as compared with 92·9, 93·5 and 89·5 respectively. Successful inoculations during the first quarter have somewhat longer incubation periods, shorter clinical courses and, if renewed clinical activity follow the first febrile attack, such renewal is likely to be confined to a period of eight weeks following the cessation of that attack. The contrast in all these respects is greatest in the case of inoculations made during the third quarter of the year.

The wide degree of scatter in the frequency of the observations deprives the results of the inquiry of a high degree of statistical significance, but the trends of divergencies are consistent and of considerable interest. *N. W.*

Beach (Ted de Vinne). **Evidence of Binary Fission of Ring Forms in *Plasmodium vivax* Grassi and Feletti.**—*Amer. Jl. Trop. Med.* 1936. Mar. Vol. 16. No. 2. pp. 147–152. With 12 figs. on 2 plates.

The evidence brought forward is the usual one, namely the presence of two or more rings in a single red blood corpuscle and the occurrence of rings with two chromatin dots which appear to have been formed by division of the single dot. It is noted that at one time these appearances were interpreted as conjugating forms. This view was largely given up and is now being replaced by the view that these forms represent binary fission. The article is accompanied by a number of microphotographs purporting to illustrate the various stages in division of the chromatin and the subsequent division of the cytoplasm of the ring to form two daughter rings. *C. M. Wenyon.*

Thomson (J. G.) & Robertson (Andrew). **The Structure and Development of *Plasmodium falciparum* Gametocytes in the Internal Organs and Peripheral Circulation.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1936. June 29. Vol. 29. No. 1. pp. 31–40. With 34 coloured figs. on 1 plate. [15 refs.]

From a study of blood films from cases of *Plasmodium falciparum* infections from various parts of the world the authors have been able to follow the development of the crescent from small solidly built parasites, through elongate spindle-shaped forms to the typical mature crescent. The various forms seen are illustrated in an excellent coloured plate. *C. M. W.*

Marchoux (E.) & Jolly (A. M. D.). Cycle évolutif complet de *P. falciparum* dans le sang circulant. [**Complete Life Cycle of *P. falciparum* in the Peripheral Blood.**]—*Ann. Inst. Pasteur.* 1935. Dec. Vol. 55. No. 6. pp. 623–631. With 47 coloured figs. on 1 double plate. [18 refs.]

The authors call attention to the fact that occasionally in *Plasmodium falciparum* infections all stages of the development of the parasite may be found in the blood. One such case and the forms of parasite seen are described in some detail. Unless this fact is realized the appearances may be attributed to mixed infections. *C. M. W.*

Chaoulitch (S.). La multiplication du *Plasmodium falciparum* (Welch, 1897) par scission binaire. [**Multiplication of** *P. falciparum* **by Binary Fission.**]—*Bull. Soc. Path. Exot.* 1936. July 8. Vol. 29. No. 7. pp. 716–722. With 1 fig. [11 refs.]

The author refers to the well-known fact that in malarial infections due to *P. falciparum* rings are commonly seen with two chromatin dots. By a series of drawings the author proves to his own satisfaction that division of the single chromatin dot and finally of the entire parasite takes place. The conclusion is that binary fission is the cause of the rapid increase in the number of parasites in malignant tertian malaria. *C. M. W.*

Mariani (G.) & Besta (B.). Difficoltà che si incontrano nella diagnosi differenziale dei parassiti malarici nei preparati colorati.—*Arch. Ital. Sci. Med. Colon. e Parassit.* 1936. Sept. Vol. 17. No. 9. pp. 567–571. With 29 coloured figs. on 1 plate.

James (S. P.) & Tate (P.). **New Knowledge of the Life-Cycle of Malaria Parasites.** [Correspondence.]—*Nature.* 1937. Mar. 27. Vol. 139. No. 3517. p. 545. With 1 fig.

This is the first published reference to observations made by the authors in connexion with the life-cycle of *Plasmodium gallinaceum* (Brumpt). They have discovered that in addition to a schizogonic cycle of development in the circulating red blood cells of the domestic fowl and a sporogenic cycle in *Aëdes aegypti*, *Plasmodium gallinaceum* has also a schizogonic cycle of development in reticulo-endothelial cells of the spleen, liver, kidneys and other internal organs and, in certain cases, in the reticulo-endothelial cells which line the capillaries of the brain of the vertebrate host. The discovery is of great interest and importance. Should a similar cycle of development occur in human malaria several unsolved problems might be elucidated.

In view of these observations the authors point out that it is no longer correct to define the Plasmodiidae as a family in which the whole of the vertebrate cycle of development occurs in red blood cells : the schizogonic cycle in endothelial cells resembles in some respects that ordinarily described as being characteristic of the Haemoproteidae. *N. W.*

Lancet. 1937. Mar. 27. p. 764.—**New Light on the Life-Cycle of the Malaria Parasite.**

This editorial comments on the significance of the observations of James and Tate on the schizogonic cycle of development of *Plasmodium gallinaceum* in the reticulo-endothelial cells of the internal organs of the fowl (see above). *N. W.*

Chorine (V.). Les réactions sérologiques dues aux euglobulines. [**Serological Reactions Attributable to Euglobulins.**]—*Ann. Inst. Pasteur.* 1937. Jan. Vol. 58. No. 1. pp. 78–124. With 2 figs. [102 refs.] [**Henry's Reaction** pp. 78–100.]

This is an admirable comprehensive study of the mechanism of Henry's reaction, Verne's resorcin reaction and the various serological reactions that have been used in the diagnosis of kala-azar.

With regard to Henry's reaction many of the author's conclusions have been published previously and have been noted in this *Bulletin* from time to time (see this *Bulletin*, 1934, Vol. 31, p. 180; 1935, Vol. 32, pp. 420, 422); they may be summarized as follows. Henry's reaction is not due to the presence of antibodies in the blood. Melanin has only antigenic properties for animals normally deprived of this pigment. Melanoflocculation is apparent three to seven days after infection; antibodies take much longer to develop. The reaction is only produced in distilled water or hypotonic solutions; antibodies act in isotonic or even in feebly hypertonic solutions. The flocculation in distilled water runs parallel with melanoflocculation; melanin acts merely as an indicator and as such can be replaced by other substances such as carmine. The chemical mechanism of the reaction is complex. The reaction is attributable to an increase in the serum of euglobulins and lipoid substances which are precipitated by distilled water. Heating to 55°C. for half an hour abolishes the reaction: this is explained by the fact that CO_2 is driven off, the serum becoming alkaline. From the clinical point of view it is immaterial whether the flocculation of the serum is measured in a dilution of one in ten distilled water or of one in five with the addition of an indicator. The clinical value of the reaction is incontestable. *N. W.*

Spanedda (Antonio). Semplificazione della melano-flocculazione di Henry con l'impiego di sangue laccato. [**Simplification of Henry's Reaction by Use of Laked Blood.**]—*Giorn. di Batteriol. e Immunol.* 1936. Oct. Vol. 17. No. 4. pp. 467–474. English summary (6 lines).

With the object of so simplifying the technique of Henry's reaction as to make its use possible for medical practitioners without laboratory facilities of any kind, the author suggests the substitution of laked blood for serum. Two or three drops of blood are mixed with 1 cc. of distilled water. A study of 122 cases has shown that the results obtained with laked blood are strictly comparable with the results obtained with serum. *N. W.*

Szauter (B.). Neues Verfahren (Dichtungsverfahren) zur Diagnose der tropischen Malaria. [**A New Concentration Method for the Diagnosis of Subtertian Malaria.**]—*Zent. f. Bakt.* I. Abt. Orig. 1937. Feb. 16. Vol. 138. No. 5/6. pp. 303–306. With 1 fig.

With a view to obviating certain disadvantages of the ordinary "thick drop" preparation the author worked out a new method. The method is as follows:—10 cc. of double distilled water are placed in a centrifuge tube; add to it 5 drops of concentrated acetic acid and 5 drops of blood from the patient; shake the tube till fluid is quite transparent; centrifuge for 10 minutes; take up the sediment in the centrifuge tube with a platinum loop and spread on a slide; dry over a flame; fix with methyl alcohol and stain with Giemsa. To ascertain the amount of concentration the number of white cells of the blood per field is determined: taking the value of an ordinary thin film from the patient as 1, then the ordinary "thick drop" preparation would give a 6–10-fold concentration, but the new method gives a 60-fold concentration. The method has the further advantage

over the " thick drop " preparation that the elements are lying in one plane and are therefore easier to recognize, this applies not only to malaria parasites but also to pathogenic bacteria which may be present in the blood. He considers that the method is particularly useful for the diagnosis of cases of subtertian malaria, because it enables the characteristic crescents to be detected even when very scanty in the peripheral blood. *E. D. W. Greig.*

Vaucel (M.) & Hoang-Tich-Try. Réactions de malaria-floculation au Tonkin. [**Malaria Flocculation Tests in Tonking.**]—*Bull. Soc. Méd.-Chirurg. Indochine.* 1936. Oct. Vol. 14. No. 8. pp. 1101–1114.

This study, based on the results of 1,617 reactions carried out with 539 serums, indicates that flocculation tests, as an aid to the diagnosis of malaria, have but a limited value in tropical countries where there are commonly numerous causes of serum instability. *N. W.*

Decourt (Philippe). Les bases d'une thérapeutique curative du paludisme. [**Principles of Treatment of Malaria.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 5. pp. 358–369.

The author has previously shown that quinacrine (atebrin), though pre-eminently a schizonticide, is not without some action on crescents [see this *Bulletin*, 1934, Vol. 31, p. 693]. After a preliminary course of quinine, quinacrine acts as a gametocyticide. Praequine (plasmoquine), though having a specific action on the sexual forms of the parasite, has also an action on schizonts which is of great importance. Its toxicity does not allow of its use in doses sufficient for it to act as a schizonticide, but in much smaller doses it is capable of interrupting the schizogonic cycle of development without destroying the schizonts. Thus is explained the power of this drug to diminish the number of relapses. The antischizogonic dose of praequine is approximately the same as its gametocyticide dose.

In certain circumstances quinacrine, without destroying the parasites, is capable of arresting the asexual reproduction of schizonts and their transformation into gametocytes. The dose necessary to bring about this refractory condition of the host with regard to the parasite varies in different conditions. Once established it lasts about three weeks, when a minimum additional dose is capable of prolonging it for a like period.

The antischizogonic action of quinacrine acts chiefly on the parasites in the circulation while that of praequine appears to act chiefly on the parasites fixed in the viscera.

The indications for treatment in primary attacks of malaria are very different from those in relapses. The parasite in primary attacks, " paludismes d'inoculation," having just passed the sexual phase in the body of the mosquito, has been transferred to a new medium : it has thus acquired an enhanced schizogonic potential. The author states that the higher the schizogonic potential of the parasite the greater its vulnerability to drugs. Moreover, most of the parasites in primary attacks are in the circulating blood. Treatment in primary attacks ought, therefore, to be energetic, with the aim of destroying all

the parasites in the circulating blood. In the treatment of relapses it is otherwise ; here one should be content to reinforce the resistance of the patient by the creation and maintenance of the " refractory condition " referred to above. *N. W.*

FULTON (J. D.). **Studies in the Chemotherapy of Malaria. The Inhibitory Action of Anti-Malarial Drugs on Blood Lipases.**—*Ann. Trop. Med. & Parasit.* 1936. Dec. 23. Vol. 30. No. 4. pp. 491–500. With 2 figs. [15 refs.]

Quinine has long been known to inhibit enzymes of varied nature. " With a view to obtaining information as to how a drug acts, an investigation of the influence of various antimalarial drugs on different enzyme systems is being undertaken in collaboration with Sir S. R. Christophers. In the present communication are recorded the results of a study of the inhibitory action of some twenty pure drugs of known constitution and activity on the lipases of rabbit, monkey and human serum." The ingenious method by which the coefficient of inhibition of the different drugs is calculated is clearly described. It was found that a constant value for pH is important in the case of salts, with regard to dissociation to base. The higher homologues of quinine, where the methyl of the methoxy group has been replaced by longer side chains, are the most active inhibitors. This is especially true for human lipase. This greater inhibitory power is associated with a low partition ratio between red cells and serum ; the haemolysing power of these drugs for red cells is reduced by the presence of serum.

A highly technical study of this nature does not lend itself to summary. Those interested will study this contribution with profit. *N. W.*

RICHARDSON (Shaler). **The Toxic Effect of Quinine on the Eye.**—*Southern Med. Jl.* 1936. Dec. Vol. 29. No. 12. pp. 1156–1163. With 5 charts. [20 refs.]

This paper deals at some length with the literature of cases of amaurosis and amblyopia resulting from the administration of quinine. Nine cases are reported. The possibility of congenital blindness being caused by the administration of quinine to the expectant mother has to be considered. Animal experimentation suggests that the toxic effect of quinine on the ganglion cells of the retina is the primary cause of the damage done in these cases ; the vasoconstriction of the retinal vessels is a secondary cause. In treatment the use of vasodilators is recommended and the suggestion is made that sympathectomy might give good results in cases with persistent contraction of the visual fields and impaired vision. *N. W.*

MALDONADO SAMPEDRO (Mariano). La totaquina en la terapeutica del paludismo. [**Totaquina in the Treatment of Malaria.**]—*Medicina Países Cálidos.* Madrid. 1936. Aug.–Sept. Vol. 9. Nos. 8 & 9. pp. 353–364.

The Anti-Malaria Institute of Navalmoral de la Mata in Spain was one of the centres selected by the Malaria Commission of the Health Organization of the League of Nations to carry out comparative tests of the efficiency of totaquina in the treatment of malaria. Totaquina

is a standardized preparation of the total alkaloids of cinchona bark, containing not less than 15 per cent. of quinine. This report from that Institute records the results of the treatment of 54 cases, 35 benign tertian and 19 malignant tertian. In benign tertian cases the action of totaquina is comparable with that of quinine. In malignant tertian cases the drug is of less value, in the doses employed, and the author is of the opinion that it would be necessary to associate with it some drug with gametocidal properties, such as plasmoquine. Relapses were frequent in both types of infection but not markedly more so than is commonly observed with short courses of quinine treatment.

N. W.

Golse (J.). Pharmacologie de la médication antimalarique. Le quinquina et ses alcaloïdes. Succédanés synthétiques. [**Pharmacology of Drugs used in Treatment of Malaria : Quinine and its Alkaloids : Synthetic Remedies.**]—*Jl. Méd. de Bordeaux.* 1937. Mar. 6–13. Vol. 114. Nos. 10–11. pp. 309–327.

The title of this contribution sufficiently indicates its nature. It is an interesting article though it contains nothing original. *N. W.*

Wallace (R. B.). **The Control of Malaria on Estates by Mass Treatment with Atebrin.**—*Malayan Med. Jl.* 1936. Dec. Vol. 11. No. 4. pp. 187–213. With 21 charts.

The title of this well documented paper sufficiently describes its scope. On certain estates since 1933 the mass treatment of the populations with atebrin has been the sole measure of malaria control employed ; in others this measure was used to reinforce attempted control by antilarval measures. For five successive days two tablets of atebrin were given at the morning muster to each adult ; in the afternoon one more tablet of atebrin and one tablet of plasmoquine simplex (0·01 gm) were given. One tablet of plasmoquine simplex was given alone on the sixth and the seventh days. After this initial intensive treatment a " follow-up " treatment, which consisted of a weekly dose of three or four tablets of atebrin, on one or on two days a week, was started. In some cases this was continued for as long as four months. The malaria rate was practically *nil* during the period of administration. Many thousands of coolies were treated and no serious toxic effects were noted. The author does not contend that mass treatment is the best method of controlling malaria under all conditions ; it is, however, a method of value and in certain conditions it may be the method of choice. *N. W.*

Lega (Giulio) & Casini (Guido). L'azione dell'atebrina nella malaria, specialemente in rapporto alle recidive. [**Atebrin in the Treatment of Malaria with Special Regard to Relapses.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 6. pp. 404–413. English summary.

The chief interest of this report on the treatment of malaria with atebrin lies in the fact that the 15 cases reported were kept under observation for two and a-half years. Ten were *vivax* infections, five *falciparum*. Atebrin was given daily for seven days : the treatment was repeated whenever relapse occurred. The usual daily doses (0·3 gm. for adults, 0·15 gm. for children) were employed.

In no case was a relapse observed within 15 days of the last febrile attack : in 4 cases there were relapses within the first two months, in 8 cases between the 7th and 10th months. In the *falciparum* infections the first relapse was followed by the complete disappearance of infection : in the *vivax* infections the first delayed relapse was quickly followed by another attack. The duration of benign tertian infections was from 10 to 18 months in most cases ; in one case it ceased in the third month and in two it was prolonged to 29 months. No clinical manifestation of subtertian fever was noted later than ten months after the initial atebrin treatment ; infection rarely persisted more than eight months. *N. W.*

Schechter (Abraham J.) & Taylor (Haywood M.). **Atabrine Pigmentation.**—*Amer. Jl. Med. Sci.* 1936. Nov. Vol. 192. No. 5. pp. 645–650. [23 refs.]

This is a description of the atebrin pigmentation that commonly follows the administration of that drug and a discussion of the difficulties of diagnosis to which it might give rise in the absence of a history of malaria treatment. Mild jaundice, pernicious anaemia, the yellow pigmentation of carotinaemia, Addison's disease, subacute bacterial endocarditis, yellow fever and pigmentation from picric acid, such as occurs in TNT workers, are among the conditions that may be more or less simulated. Atebrin pigmentation is diffuse and most evident on the dorsum of the arms, hands and feet ; it is also clearly seen on the forehead and face. The authors have failed to note any significant degree of discolouration of the sclerae. They believe that anaemia is of importance as a contributory cause of pigmentation. Occasionally the pigmentation is persistent : four cases showed pigmentation 6 weeks after the final dose of atebrin, one 8 weeks, one 16 weeks, and two 18 weeks.

The tests for atebrin in the urine are simple and reliable. The test used by the authors is a modification of that of Tropp and Weise [this *Bulletin*, 1934, Vol. 31, p. 171]. They use hydrochloric acid for extraction of the atebrin from the ether, instead of sulphuric acid as recommended by Tropp and Weise, thus avoiding the possibility of confusion arising from the presence of quinine, quinidine or even plasmoquine. Their method is fully described. *N. W.*

Siegenbeek van Heukelom (A.) & Overbeek (J. G.). Behandeling van de acute malaria-aanval met atebrine pro injectione. [**Treatment of Acute Cases of Malaria by Atebrin Injections.**]—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1936. Vol. 25. No. 3. pp. 315–330. With 3 figs. [31 refs.] English summary.

" Review of results obtained by intramuscular injections of atebrin in 119 cases of acute malaria between Aug. 5, 1935, and May 13, 1936. A series of 100 cases, containing subtertian 62, benign tertian 16, quartan 5 and mixed infections 17, occurring in 17 natives, 11 Chinese, 8 Japanese, 1 Arab and 3 white or Eurasians, has been compared with a similar series, treated at the same hospital (C. B. Z. Batavia) between Aug. 5, 1931, and May 13, 1932, with the routine oral chinine method.

" With atebrin injections fever disappeared within 48 hours in 87 per cent., with chinine in 77 per cent. of cases. The difference has no value statistically.

" Intoxications, as described in several English papers, are discussed at large. As yet no clear cases of intoxication are observed at Batavia. In two patients epileptiform insults occurred; both died. Clinical and post mortem findings however proved pre-existant disease of the brain. In patients having cerebral symptoms, intramuscular administration of atebrin is to be considered very carefully. One patient developed a troublesome religious mania; further observation revealed schizophrenia. No other cases of cerebral excitation are on record.

" Local reactions, abdominal spasms or frontal pains were not heard of. Yellow discoloration of the skin occurred only twice. As many patients with severe anaemia are included in this series, special attention was given to the " knocked out feeling," described by Vardy. Although a rather sharp decline of haemoglobine occurred in several cases, no such feeling was complained of by our patients.

" Intramuscular atebrin has no effect whatever on subtertian gametocytes.

" Atebrin, as given in this series, twice 300 mg. intramuscular, is not sufficient to prevent relapses. The best after-treatment is still sought after.

" A special warning is given against the simultaneous use of plasmochin and atebrin.

" As clinical evidence about the frequency of severe intoxications is still of a contradictory character, mass-treatment by atebrin injections should be discouraged."

CHIN (Koyu). Ueber die pharmakologische Wirkung des Atebrins. [**Pharmacological Action of Atebrin.**]—*Taiwan Igakkai Zasshi (Jl. Med. Assoc. Formosa).* 1937. Jan. Vol. 36. No. 1 (382). [In Japanese pp. 138–159. With 6 figs. [17 refs.] German summary pp. 159–160.]

The author states that whilst the action of atebrin in malaria has been studied the pharmacological action of the drug has not been investigated systematically up to the present. The results of his investigations show that—atebrin acts chiefly on the central nervous system. The M.L.D. for frogs and mice is 0·2 mgm. per gram body. weight when injected subcutaneously, for rabbits it is 8 mgm. per kilo. bodyweight when injected intravenously. In rabbits atebrin produces irregular respirations, which become arrested fairly quickly. The excised hearts of frogs and rabbits are paralysed by atebrin chiefly by action on the heart muscle itself. The peripheral blood vessels of the frog are contracted by atebrin, whilst the ear blood vessels of the rabbit are dilated for a long time: this result is probably due to atebrin acting directly on the muscles of the blood vessels. Acting on the pregnant and non-pregnant uterus of the rabbit and guineapig in small doses atebrin stimulates, but in large doses it has a paralysing action after initial stimulation. In nerve muscle preparations of frog's gastrocnemius atebrin depresses the excitability of motor nerve endings. *E. D. W. Greig.*

SALAH (M.). Investigations on the Treatment of Malaria with Atebrin.—*Jl. Egyptian Med. Assoc.* 1936. Dec. Vol. 19. No. 12. pp. 717–736. [25 refs.]

CHOPRA (R. N.), SEN (B.) & ROY (A. C.). **Individual Variations in the Effectiveness of Synthetic Anti-malarial Drugs (a Preliminary Note).**—*Indian Med. Gaz.* 1937. Mar. Vol. 72. No. 3. pp. 131–135.

The authors describe seven cases of malaria in which the administration of atebrin or plasmoquine, or both, was not attended with the results that experience leads one to expect. The cause was defective absorption. This may be due to heavy hookworm infection, or hypochlorhydia, which is commonly associated with dysentery and colitis, or the rapid passage of the drug through the small intestine in chronic diarrhoeas and dysentery. Acute or chronic inflammation of the mucous membrane of the intestinal tract modifies absorption. It is open to question whether the combination of atebrin and plasmoquine in the dragées used renders the absorption of the individual drugs more difficult. In some of the cases cited atebrin was not absorbed when administered in the combined form though it was subsequently absorbed when given alone. *N. W.*

VAN NITSEN (R.). Le traitement de la malaria par le paludex, nouveau dérivé quinoléinique. (Etude basée sur 1,000 observations d'indigènes.) [**Treatment of Malaria with Paludex, a New Quinoline Derivative. Study based on 1,000 Native Cases.**]—*Ann. Soc. Belge de Méd. Trop.* 1936. Sept. 30. Vol. 16. No. 3. pp. 387–407. With 3 graphs.

—— & SERRA (D.). Le paludisme chez les Européens traités par le paludex. [**Malaria in European Patients treated with Paludex.**] —*Ibid.* pp. 409–428. With 1 chart.

Paludex is a copper containing organic preparation, prepared in the "Meurice" Laboratories of the Union Chimique Belge. It is described as copper oxyquinoline sulphonate of soda; a greenish amorphous powder soluble in water, neutral reaction and stable in ordinary conditions of temperature and humidity. The daily dose recommended approximates 0·02 gm. per kilogram of bodyweight for adults, and relatively somewhat bigger doses for children. For an adult of 70 kilograms or over the dose is 1·50 gm. It is given in divided doses and in tablet form, each tablet containing 0·20 gm. of paludex.

If all the claims in this paper, based on the observation of a very large series of cases, be substantiated, paludex compares very favourably with any drug that has hitherto been used in the treatment of malaria. It is said to be equally effective in the treatment of all three forms of the disease; the great majority of cases treated were *falciparum* infections. Schizonts and gametes of all varieties of parasite disappear from the peripheral blood under treatment: after six days' treatment schizonts had disappeared from the blood of 93 per cent. of the cases treated; gametes from 87 per cent. Fever is quickly controlled. In only six cases of a series of 163 had treatment to be prolonged more than seven days: in such refractory cases the authors have combined paludex with quinine with good results. They assert that small doses, 0·50 gm. of quinine with from 0·60 to 1 gm. of paludex a day, are more effective than are the normal doses of either drug taken alone. No symptoms of intolerance have ever been observed even with doses of paludex larger than those recommended: it has been retained and absorbed in cases in which vomiting has been

troublesome. It has, moreover, a well marked tonic effect. A ten days' course of treatment, 1·50 gm. a day, followed, after an interval of from six to eight days, by a similar ten days' course, has frequently been given with no untoward happenings, and with good results. Observations have not been sufficient to determine the frequency of relapse after treatment with paludex.

A number of illustrative cases are described and temperature charts are given.

The paper would have perhaps gained in value had it been possible to have treated an equivalent number of unselected cases with quinine alone, to serve as a control. It is also regrettable that the diagnosis of the form of parasite was not made in each case; as stated, the vast majority of cases appear to have been malignant tertian infections.

N. W.

VAN NITSEN (R.). Contribution à la chimiothérapie du paludisme. [**Chemotherapy of Malaria.**]—*Bruxelles-Méd.* 1937. Feb. 14. Vol. 17. No. 16. pp. 587–592.

This is a further communication on the results obtained in the treatment of malaria with paludex (see above). More than two thousand cases have been treated with very satisfactory results. Paludex is stated to act on both schizonts and gametes. The author now gives slightly increased doses. For an adult one gramme is given by mouth the first day, 1·20 gm. the second, the dose being increased by 0·20 gm. a day till the sixth day, when 2·0 gm. are given. This dose of 2 gm. can be continued for several days if necessary. Still better results are obtained by the association of quinine with paludex, quinine 0·50 gm. and paludex 1·00 gm. for six days. A second similar treatment is given after an interval of from 8 to 14 days. The action of this combination is more rapid than that of either of its constituents. Whenever quinine is contraindicated paludex is given alone.

N. W.

REYNTJENS. Note sur des essais thérapeutiques anti-malariens par le quinimax. [**Treatment of Malaria with Quinimax.**]—*Bull. Méd. du Katanga.* 1936. Vol. 13. No. 3. pp. 97, 99–103.

VAN NITSEN (R.). Le quinimax dans le paludisme des nourrissons indigènes. [**Treatment of Native Children with Quinimax.**]—*Ibid.* pp. 114–15, 117–19.

A tablet of quinimax contains chlorohydrate of quinine 4 cgm., and a mixture of the chlorohydrates of quinidine and cinchonidine 1 cgm. Ampoules containing the same doses per cc. are used for hypodermic medication. Dr. Reyntjens obtained disappointing results in the treatment of a series of malignant tertian cases by subcutaneous injection and the tablets were of no appreciable value as a prophylactic. Dr. van Nitsen treated 58 infants infected with *falciparum*. He considers that 15 cgm. of quinimax has a therapeutic value comparable to that of 25 cgm. of quinine chlorohydrate.

N. W.

SPAAR (Eric C.). The Therapeutics of Malaria.—*Jl. Trop. Med. & Hyg.* 1937. Jan. 15. Vol. 40. No. 2. pp. 13–15.

Riolo (Pietro); Serio (Francesco). Sulla cura di Maurizio Ascoli nelle infezioni malariche. Nota II. Stabilità dei risultati. Bonifica umana [Riolo]. Nota III. Associazione con la chinina nelle ricorrenze febbrili. Bonifica umana [Riolo]. Nota IV. Resistenza e ipersensibilità [Serio]. [**Ascoli's Treatment of Malaria Infections. II. The Lasting Quality of the Results. III. Association with Quinine in Febrile Relapse. IV. Resistance and Hypersensitiveness.**]—*Riv. di Malariologia.* Sez. I. 1936. Vol. 15. No. 6. pp. 414–415; 416–422; 423–427. [13 refs.]

In 1935 Riolo reported the results of treatment of 18 cases of chronic malaria with splenomegaly by intravenous injections of adrenalin (see this *Bulletin*, 1936, Vol. 33, p. 276). In Note II he states that 15 of the 18 patients have been followed up and nearly two years after the termination of treatment the general health of all is excellent. None has suffered from relapses and the size of the spleen remains within the limits noted at the end of treatment.

Note III is a record of the treatment of twenty cases of chronic malaria, all the victims of frequent relapses. The treatment was started in each case during such a febrile relapse. Treatment with adrenalin injections was supplemented with quinine given by mouth, six 20 cgm. tablets a day, at hourly intervals, as long as the fever lasted. The results were uniformly good. The patients were kept under observation for a year, at the end of which time only one patient had a spleen that was palpable. Both *vivax* and *falciparum* infections were treated. The authors consider that by this treatment complete eradication of infection can be secured.

Note IV, by Serio, is a description of two exceptional cases, the first showing remarkable resistance to the adrenalin treatment, the second unusual hypersensitiveness to adrenalin. In the former no less than 52 injections of 1/10 mgm. were required, in the latter an injection of 1/20 mgm. caused severe symptoms necessitating a return to 1/50 mgm. doses. The ultimate results of treatment in both cases were excellent. *N. W.*

Pomilia (Giovanni). Sulla cura di Maurizio Ascoli nell'infezione malarica. [**Ascoli's Method of Treatment of Malaria Infections.**]—*Riv. Sanitaria Siciliana.* 1936. Dec. 15. Vol. 24. No. 24. pp. 1360, 1363–4.

The author describes the treatment of six cases of chronic malaria with enlarged spleens by Ascoli's method—the daily intravenous injection of adrenalin, for 20 days, in doses from 1/100 to 1/10 of a milligram. He writes with enthusiasm of the results obtained and considers the treatment as a most valuable addition to malaria therapy. The maximum dose was well supported in all cases save one: this patient suffered from chronic appendicitis and the injection of 1/10 mgm. of adrenalin gave rise to severe but transitory abdominal cramp. *N. W.*

Gosio (Renato). Su di un nuovo capitolo di terapia della infezione malarica. [**Ascoli's Treatment of Malaria Infection.**]—*Policlinico.* Sez. Prat. 1937. Feb. 8. Vol. 44. No. 6. pp. 265–6, 269.

A short discussion of the mode of action of the treatment of chronic malaria infection by the intravenous injection of adrenalin. *N. W.*

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